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Geological Survey of Japan.

Some Notes

on

Places of Interest

in the

Chiugoku.

Prepared by Benj. Smith Lyman,
Chief Geologist & Mining Engineer,
for the use of

Messrs. Yamao and Oshiro,
on their journey of
1879.

Adakae Copper Mines

The Adakae mines are about one half [illegible] westerly from the main road at Adakae village (2½ ri from Yasugi, and 6½ ri from Yonago) and are 3 ri from the hotel and Kenchoo at Matsue.

The mines are worked by these Companies

Hoomanzan
Ushirohotani
Hidokaze (very small)
Takegatawa (very small)
Iwazaka (idle)
Bitshookoshi (idle)

Hoomanzan.

The Hoomanzan is a company formed in Meiji, Kyoor, & consists of four men: Sudzuki [illegible], Katsube, Moldemon, Fujikawa Bun[illegible], Sato Choozaemon. The mines worked by it were opened 14 years ago and belonged then to the Daimiyoo.

There are (it is said) about 15 veins and

[illegible] and [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
best place they could [illegible] [illegible] [illegible]
out in other places it had [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible]

sometimes three) cakes of Arados weighing in all about 16 kamme; and about 5 kamme of Kawadoo, which is added to the 10 kamme ore of the next sandling operation.

The ore brought out from the mines is not weighed before washing; but the washed ore is probably two or three tenths of the unwashed ore; sometimes, however, six tenths, as the proportion is very variable.

1 July to 31 Dec. 1877.

Raw (washed) ore sandled 93648 kamme

Arados produced (about 13 1/2 %) 12694 "

Days:

mines	179
furnaces	179
	358

Days' work:

mines	10631
furnaces	10075
	20706

Expenses:

mines	$20676.[illegible]
furnaces	50380.[illegible]
	71050

Tax ——————— 14 816

1 Jan. to 3 June 1878

Raw (washed) ore smelted 76374 Kamme

Aradoo produced (about 16 %) 12634 "

Days:

mines ——————— 177

furnaces ——————— 177

354

Days' work:

mines ——————— 11825

furnaces ——————— 9603

21428

Expenses:

mines ——————— $3264 344

furnaces ——————— 5739 491

9204 041

Tax ——————— 14 816

In Aug. 1878:

Raw (washed) ore smelted 7776 Kamme

Aradoo produced (about 14 %) 1125 "

Number of smelting operations 58.

100 kin aradoo sell for $15 at the mines or $17.50 at Oozaka; the difference $[illegible] [illegible] the cost of carriage.

Day ——— 14 316

1 Jan. & 3 June 1878

Raw (crushed) ore smelted 7637 4 tonne

Bruce produced (about 14½%) 12634 "

Days:

Mines ——— 177

Furnaces ——— 177

354

Days work:

Mines ——— 1825

Furnaces ——— 9603

21428

Expenses:

Mines ——— $3264 544

Furnaces ——— 5939 497

9204 041

Day ——— 14 316

[illegible] 1878:

Raw (crushed) ore smelted 7776 tonne

Bruce produced (about 14½%) 11125 "

Number of smelting operations 58.

100 kilo [illegible] sell for $15 at the mines or $17.50 at Oyala; the difference $2.50 [illegible] the cost of carriage.

[illegible] [illegible]

[illegible] [illegible]

[illegible] [illegible]

Ushirotani.

The Ushirotani mines are some 200 & 300 yards down stream from the Noomanzan. The owner is Katsubei Moloemon and the head of the workers is Gomamoto Sou-jiri. The mines were begun 7th month, 9th year of Meiji.

There is (it is said) only one mine and one vein with a dip of 70° northerly. The ore at most is about 4½ sun wide. There appear to be two "ore shoots" in the vein of which the eastern is the longer. The ore and the country rock are like those of the Noomanzan. There are 19 bamboo pumps of 12 ft each in the mines but there is not much water.

There are [illegible] kilns and [illegible] kilns

From 1 July 1877 to 30 June 1878.

Raw (washed) ore smelted — 133,759 [illegible]

No. [illegible] produced (about 9 [illegible]) — 1287 [illegible]

From 1 July to 31 Dec. 1877:

Days:

mines	84
furnaces	86
	170

Days work:

mines	7857
furnaces	2793 4/10
	10650 [illegible]

Expenses:

mines — $ [illegible]

furnaces — [illegible]

[illegible]

Tax — [illegible]

From 1 Jan. to 30 June, 1878:

Days:

mines — 172

furnaces — 167

339

Days' work

mines — 18997 [illegible]

furnaces — [illegible]

26347 [illegible]

Expenses:

mines — $ 3715 [illegible]

furnaces — 4404 [illegible]

8120 [illegible]

Tax — [illegible]

Workers employed:

mines — 135

furnaces — 75

210

The washing is reckoned under the head of

"Furnaces."

There is a rough map of the underground workings of the mine.

Yuda Coal Mines

The Yuda coal mines are called 7 cho o southerly from a point on the main road that is 1½ ri from the Adakai copper mines and the same distance from the Matsue hotels and Kenchoo.

The mines were at first worked by the government sixteen years ago (Ino toshi), and the coal was burned by a steamer. The steamer, however, stopped running at the end of eight years and the mining was abandoned. In Meiji, Ed. year 10th month, some Chooshin men, who are said to have had insufficient capital, took up the mines and worked them for about five months and since that no digging has been done. The mines have all fallen in and are inaccessible.

The following is the section as described to me. I saw only the twelve feet of upper shaly rock.

ft. 120	"Chordo" greenish gray and light brown shaly soft [illegible]
10	soft blackish earth.
20	Coal.

The roof is evidently too soft; and wooden props had to be set every three feet. As the coal had dipped away from the mouth of the mines, water accumulated inside and made the mining difficult. Much earth was also brought out from the mine, and spoiled the adjacent rice fields and so caused expense.

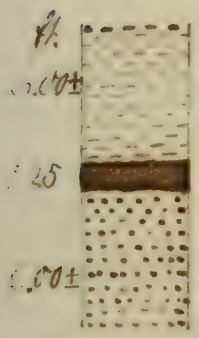
The coal is black and thining, and not fibrous. It is said not to have fallen to powder even when exposed to the air in heaps for months. A heap of coal dust (Slack) is said to have [illegible] fire and to have burned for three years. There is now no coal to be seen except very small bits that have been exposed to the [illegible] years.

If mined at all, the coal should be surveyed [illegible] to find a place to attack if [illegible] would drain itself. Perhaps the thickness and quality have been exaggerated. If not, working might pay.

Akasaki Coal Mines

The Akasaki coal mines are in the edge of Matsue about half a ri or less northeasterly in the Kenchoo. Only very little mining has been done, and that was done in April (8th) 8. There are three small drifts in a single [illegible] hill; the principal one at (f) said to be about [illegible] fathoms long; and at (h), about 10 fathoms west of (f) and about 15 feet higher, two holes about [illegible] fathoms apart and each said to be about six fathoms long. All three holes appear to be on the same bed of coal, which dips at (h) 20° N 5° E.

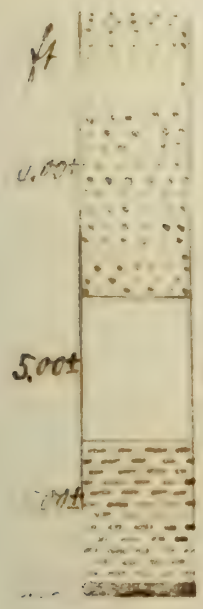
Section observed at (f):



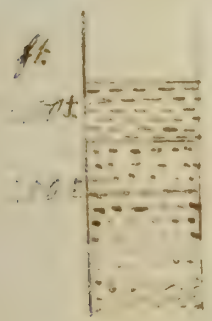
ft.	
[illegible].00±	Light gray soft shales.
[illegible].25	Coal, weathered brown.
[illegible].00±	Soft greenish gray sand rock weathering light brown.

Mineral Coal Mine.

Section observed at (h):

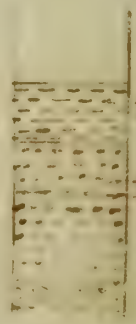


Section at (g) (20± rods N. of E. of (f)):



Section observed at (h):

Section at (g) (20t yardsmo E.N.E. of (f)):



Matsue Pottery.

About half a ri north of the Matsue Kenchoo there is a small pottery, where a few fine articles are made. The pottery is said to be more than 100 years old. There is but one kilu (13 fathoms long by 2 fathoms wide) now used; but there is one more disused. The clay comes from Mishiromura in Yokaragoori, 6 ri southwest of the kilus; and they said at the kilus that the same place [illegible] the clay for the Fujina potteries. (but see next page).

Fujina Potteries.

The Fujina Potteries are a couple of hundred yards northwesterly from the main road at the village of Fujina about 1 ri westerly from Matsue. They one said to be 200 years old. There is one kilu 28 fathoms long by three fathoms wide, with 11 ovens; one kilu about 10 fathoms long by 2 fathoms wide, with 6 ovens; and another rather smaller kilu. There are about 100 potters' wheels there. One three bakings: the first is for the white biscuit (ji); the second is for the yellow glaze (uwagusuri) and the third is for the painting. The two first bakings take about two days each and the third time much less. The clay is said to come from Midzuru (the same as the Mishiro of the preceding page?)

Fujina Potteries.

The Fujina Potteries are a couple of hundred yards northwesterly from the main road at the village of Fujina about 1 ri westerly from Matsue. They are said to be 200 years old. There is one kiln 25 fathoms long by three fathoms wide, with 11 ovens; one kiln about 10 fathoms long by 2 fathoms wide, with 6 ovens; and another rather smaller kiln. There are about 100 potters wheels. There are three bakings: the first is for the white biscuit (ji); the second is for the yellow glaze (yaguguri) and the third is for the painting. The two first bakings take about two days each and the third time much less. The clay is said to come from Hidzuru (the same as the Mishiro of the preceding page?)

Tamadzukuri.

As Tamadzukuri, 15 choc south of Yumachi on the main road, which is about 1½ ri [illegible] from Matsue, there are three hot springs with temperatures from 138° F. to 147° F. One of them is in the yard of the principal hotel (Kishimura) and the two others are close by. The hot water seems to have very little mineral matter in it. The springs issue from the alluvium and from a light brown sandstone that belongs to the Kamoikotan group.

At that hotel and at other houses in Yumachi and on the road eastward from Yumachi [illegible] green jasper and smoky quartz are cut into small ornaments very neatly. The stones are found in several places, near Tamadzukuri, almost a holly on the east side of the river there, towards Fujina and inside of Fujina, partly near (in the south of) the main road east of the Fuji[illegible] potteries; but one large crystal [illegible] quartz was found on the west side of the river near Tamadzukuri. The stones doubtless all come from rocks of the Kamoikotan group

Thermodynamics.

Among the ornaments cut are small magatama of green jasper in imitation of ancient ones that are found in (or on) the ground near Tamadzukuri. The landlord of the hotel himself knows of five ancient magatama that have been picked up in the village, the largest about two sun long. They are believed to have been made by the gods and are therefore collected by the Shintoo temples. In the miya on the hill near his house there are three ancient magatama preserved. The largest is about 0.11 long, of reddish chalcedony; smallest about 0.07 long of similar but rather paler material; and the other about 0.09 long of dark green jasper,

Sidzumo Iron Works.

In the region about Minari (8½ ri southerly from Tamadzukuri) there are eight iron making places, of which however only three seem to be working; namely: the Amegawa datara, 1¼ ri easterly from Minari; the Unedatara 1¼ ri southeasterly from Minari; the Makibara datari. The rest are small or not at work and are at: Sotozaki (2 ri easterly from [illegible]) the most flourishing, but owing to imprudence in money matters has now become less flourishing; the Shikatani; the Bokura; the Kiimokama; and the Yashirodani.

The rocks of the region are all of the Kamoikotai Group, chiefly a very easily crumbling granite, which contains [illegible] of iron ore. The rocks is either cut down and broken up by hand and washed with [illegible] water; or the river sand is washed from ore it contains; or ore is taken from [illegible] the result of the natural [illegible] The quality of these three kinds [illegible] ferent, owing to the different [illegible]

they have been affected by exposure to the air a [illegible] or longer time; and the longer the exposure has been (longest of course in the [illegible] ground and least in the river sand, which has its altered surface continually worn off) the more fusible is the ore. The three different kinds of ore are mixed in smelting. — At Notoke yama in Oomaki mura, 3 ri south of Amegawa, there is said to be a vein of magnetite; but as it is only 0.2 or 0.3 wide it is quite unworkable.

Amegawadatara.

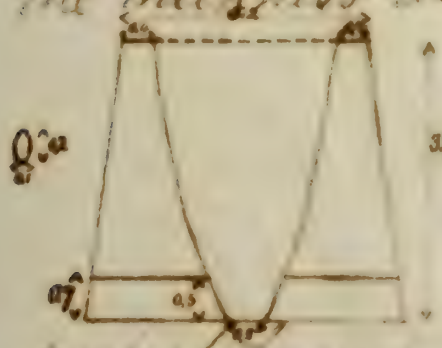
The iron works at Amegawa are over 100 years old. They are in a high building about fifty feet square.

Tatara. — The wooden bellows (tatara), which gave the name to the iron works because treading the bellows is one of the principal parts of the work to be done (just as forging is the chief work at the bloomary forges of western countries), are quite large and are worked like the tatara of an oil well by treading upon them. They are double, that is two boxes placed end to end, with the hinges at the outer ends, so that both bellows are

worked by one man who treads alternately upon their top boards. Each top board is five feet long by three feet wide, and the end that moves falls and rises about 1½ feet. There is such a pair of bellows in each side of the iron furnace, and the blast is carried to the furnace by nineteen (wajiresh kiro) in a row on each side. The kiro is chiefly of bamboo about .15 in diameter and from 2.3 to 3.8 long according to its position and at the furnace end is of clay for a length of about two thirds of a foot, and at the very end with an inside diameter of 0.06, an outside one of 0.09.

Furnace.— The building of a furnace is begun by digging a hole in the ground 12 feet deep, 7 feet long and 3½ ft. wide, inside measure, exclusive of a wall about it 0.5 or 0.6 thick made of stones (granite and other kinds). From the bottom there is made a horizontal drain to some neighboring hill side. Then the bottom of the hole is filled with large stones to a depth of 1½ ft. Then the rest is filled with red and black clay to a depth of seven feet from the bottom or five feet from the top. Then

the next 4 ft. are filled with large live coals, and over that 6 ft. in depth of fine ashes are placed; and these five feet are called the Fukutoko. The toko with the parts below is kept as permanent as possible; and upon it (above the surface of the ground) is built the furnace proper (Kama), anew for each operation. The Kama is built of a common yellowish clay (found in the hills and containing granitic sand and pebbles but worked with the foot in water a couple of hours); and is 9½ ft. (but other places varying from 8 to 10 feet) long by 3.2 wide and 3.7 ft. high outside measures, with the outer sides slightly sloping (battering); and the inner sides still more sloping at first, so that the thickness at the top of each side is 0.7 wide, and along the centre line of the bottom there is only a width of half a foot that is flat. But the lower part of the wall that is so thick at the top of the operation soon wears very much thinner. There is a hole for each bird; and it is inclined from a height of 0.7 in the outside of the wall



of the Rama to a height of 0.5 on the inside; and it is of an elliptical section, 0.5 high and 0.1 wide! Through these holes the progress of the smelting can be seen at the side in the kern. Also at the middle of each end of the Rama and at the level of the ground (there is then the operation begins) a hole 0.4 in diameter, through which likewise the progress of the smelting can be observed. At the end of the first twenty four hours, however, that hole is closed and two other similar holes are opened in the same end faces at the same level near the corners, for by this time the walls have become thin enough at the bottom to allow of that. When the Rama has been built (of wet clay) it is dried by a wood fire in one night.

The Operation.— At three o'clock A.M. the coals remaining from the wood fire are removed, and the Rama filled with large charcoal, the kiln are adjusted, the coals kindled and the bellows set in motion. At the end of about two hours, say at five o'clock, the charcoal in burning has become a little less in bulk, and is

about 0.4 shallower them at first. Then they put on iron sand, perhaps about 18 kamme, but not a weighed nor invariable quantity; then some more charcoal; and the top is made level again, and even with the top of the kama. Then when the fire has become again about 0.4 lower, more iron sand (about 36 kamme) and charcoal are put on; and so on repeatedly. The first day ore and charcoal are put on about 33 times in 12 hours (nearly three times an hour); and in the following 12 hours (at night) about the same. On the second day there are about the same number of charges; but growing quicker, so that on the third day there are 42 charges in 12 hours. On the fourth day at three o'clock A.M. (that is at the end of 72 hours), after having charged in all about 3800 kamme of charcoal and 3600 kamme of ore, they stop the blast (which has been continuous from the first kindling of the charcoal, and take away the kire. Then they break up the kama, brush off the coals that remain on the mass of metal that has been produced, and let it cool. The mass is

steel, but the outside [illegible] is [illegible]
Kera); below it is melted [illegible]
of the steel mass cools and becomes solid at once
and is called "dzuku" [illegible]
just like the pig iron of western countries
cast iron; and the dzuku is refined and made
into bar iron (but not at the [illegible]
[illegible] makes fine cast iron pots and
[illegible]. The steel mass is about 540 kamme in
weight; of which about two thirds or 360 kamme are
good steel and the remaining [illegible]
[illegible]0 kamme are "Kera". The two are separated
with the hammer. The dzuku mass [illegible]
about 360 kamme. In all then the product
is about 900 kamme; with a large kamme it
is sometimes 1200 kamme. The Kera and
the dzuku both go to the forges (Kapiya) [illegible]
other villages (Komuni, 2 ri distant; Komaki,
ri; Sakawa 3 ri; Maki 3 ri; Sumoni 2 ri) and
are hammered into bar iron, [illegible]
2½ per cent. During the whole operation stag
is running out of the holes [illegible]
Kama, and also some dzuku, about [illegible]
in the three days all together, but varying
amount with the run [illegible]

Slag that obstructs the blast of ~~[illegible]~~ kero is pushed away with a small iron rod inserted through the hole through which the kero blows, when the cooling of the metal masses has lasted only an hour or two, at about 6 o'clock A. M., the [illegible] mass is pulled out, and then [illegible] the dzuku. The dzuku without further cooling is thrown at once into a pond of water (about 12 feet square) close by in order to make more brittle by the sudden cooling; and is afterwards broken up with hammers. The hot steel mass is not thrown into water here but at some other places it is. It is afterwards broken up into small bits. The same day that the metal masses are removed, the kama is rebuilt; so that on the fifth day the blowing recommences. In a month there are therefore seven operations or eight, except when occasionally there are interruptions in consequence of disordered apparatus. In a year there are about 70 operations with a vacation of two months (7th & 8th) in the [illegible].

Wood — About 2000 kamme of wood are used in the three days operation; 1000 kamme [illegible]

drying the furnace, and 1000 kamme for making ashes. For the ashes only maki is used; and it has to be burned green, otherwise it is said the ashes are inferior (in quantity or quality).

Charcoal.— The charcoal used is very large, some pieces two or three feet long by half a foot in diameter but many smaller, and it is broken up a little before it is put on the fire. The coals in the fukutoko do not diminish, it is said, not even in two or three years; and when there is any interruption of the work the fukutoko is kept warm by a mound shaped charcoal fire on top covered with clay (0.2) thick, except a hole at one end before which a few sticks of wood burn slowly.

Ore.— The ore used at Amegawa is (in part at least) brought from a distance of over 2 rien horse back, from various places; and looks gray. It is washed at the furnace; and out of 300 loads, 150 loads are obtained. Some ore is washed in the hill side close by the furnace in the winter half of the year. The rock there is reckoned in general of inferior quality; but some parts are worse than others and some are

pretty good. Six men work together in one place and produce 800 to 1000 loads sometimes only 600 loads (of 24 kamme each) in one season of about 180 days, or 1080 days' work. But that amount of ore is reduced to one half by the final washing at the furnace. In one such season (it is said), the six men cut down and wash the rock throughout a length of about 30 fathoms by a width of about 8½ fathoms and a height of three fathoms, say 500 cubic fathoms for about 500 loads or 12000 kamme of the ore of the final washing, or about one percent of the weight of the rock.

The ore obtained from alluvial ground is of a reddish color and is called "akome"; that from the rock of the hill sides is called "mase", and that from the river sands is called "kawa" and in that order is the degree of their fusibility. On the first day of the operation the akome is always used, but as the operation proceeds the less fusible ("inferior") ore is used. The akome makes only dzuku, it is said, while the kawa makes only steel. The difficult fusibility is probably owing in part to the presence of titanium, which also gives

steely quality to iron.

Yearly.— In a year with 70 operations about 2[illegible] kamme of charcoal would be burned, and 140000 kamme of wood. Of ore about 10500 loads or 252000 kamme (or 93[illegible] tons) would be smelted in the same time. N labor there would be 6300 days' labor required. From the 3600 kamme of ore of one operation about [illegible] kamme in all of steel, kera and dzuku are obtained, that is about one quarter or 25 per cent. There is, then, most likely a great loss of iron in the slag. The product of 70 operations in the whole year would be nearly [illegible] tons, of which about 100 tons would be good steel.

Breaking.— One steel mass (including kera) that I saw was of irregular shape about [illegible] feet long by about 3½ feet wide and half a foot thick, including some cinders and ashes on top, and slag below; and the dzuku is said to be of about the same shape but much thinner. The kera surrounds good steel on all sides. The breaking up into small pieces is done partly with [illegible] hammers by eight

men; and, in the case of the more difficult lumps, by letting fall upon each of them a mass of iyuku weighing 360 kammi from a height of some ten feet. The mass is raised by means of a tread wheel, worked by three or four men; and falls between a guiding framework about 2½ ft. square. The twelve men in all do the whole of the breaking up in four days, just the time of one complete furnace campaign.

Labor.— Besides the twelve men who break up the steel (with 48 days' labor), there is, for the working of each pair of bellows one man at a time; two men for the two pairs, but in the 24 hours there are three shifts (changing about once an hour), making six men in all. Besides that there are two men for charging the charcoal, and two for the ore; making ten men in all or 40 days' labor in the four days. In building the kama 12 men are occupied two coming from outside besides the ten already mentioned. There would be then in all ninety days' labor for each operation.

Prices.— The wages of the bellows men furnace

men and steel breakers average about nine sen a day, including one shoe or rice worth four sen. It is owing to such low wages that the works still succeed no worse. A day's labor at washing the ore on the hill side amounts to about one half a load of ore of the final washing, or 12 Kamme, making wages of about ten sen a day, as it is reckoned.

The wood used comes from land that belongs to the furnace owner so that there is no price set upon it; but the carriage costs ½ sen for 100 Kamme. At Minari the best wood costs three sen for 10 Kamme, & poor maki costs 2½ sen for 10 Kamme; and charcoal 12 or 13 sen for 10 Kamme.

Charcoal at Amegawa costs about 12 sen for 10 Kamme.

The ore brought from a distance is bought at [illegible] sen a load of 24 Kamme. After washing at the furnace and reduction there by to one half its weight, it is worth 25 sen a load (yielding therefrom 64 [illegible] the cubic yard of rock).

The 12 loads (of 30 Kamme each) of these bring about $5 a load, or about $60 in all; but average say $45. A like load of [illegible] and

of the best kera (yielding 50 or 60 percent of iron) bring about $2, both alike, or $36 for the 18 loads, making $81 or $96 for the whole product of 30 loads.

The making of bar iron from dzuku and kera costs (it is said) about $20, but with inferior dzuku and kera it costs more. Bar iron is sold at Amemura for $5 or $7 for 24 kamme; that for $7 is of the best quality, that for $5 is poor, $6 is perhaps an average (and that is three cents a pound, or about sixty dollars a ton). Dzuku brings $3 at Matsue.

The chief expenses of the 70 operations of a whole year would be:

266000 kamme charcoal @ 12 sen for 10 kamme	$3192
140000 " wood @ say 2¼ sen for 10 kamme	385
10500 loads of ore @ 25 sen	2625
6300 days' labor @ 9 sen	567
Clay for furnace building (see Umedatara) 4×70	280
	7049

Something should be added for the wear and tear of tools and of the breaking machine, deterioration of the building, cost of superintendence, and interest on the capital.

The value of the products for the same year of 70 operations would be at say $90 for each operation $6300 (or at $96 it would be $6700). It would seem therefore that at present the works barely pay expenses, or even are losing a little. The information is not quite precise enough to decide with certainty whether there is any profit or not.

Wanted.— We are in want of specimens of akome, kawa and masa ore separately marked; also of dzaku and of hag (Kanakuso). We have already some specimens of ore with quality unmarked, and of "good steel" and of "good kera". In each case average specimens would be the most useful; but specimens of the best quality might be added, if convenient.

Note!— The day I visited Amegawa the furnace was not in blast, owing to some repairs needed for the bellows; and the fukutokewa merel kept warm by the temporary mound shaped fire over it. The operation is given above as it was described to me. [illegible] such inquiries are unusual and were quite unexpected, and so not [illegible] prepared

for, it is possible the answers were not always perfectly exact, though evidently as nearly so as under the circumstances they could be. It will therefore be well to compare them with those obtained at the closely similar establishment of Unedatara and with the observations of the operator there.

Uredatara.

The lion works at Uredatara are [illegible] and [illegible] (Sauc), and are a near [illegible] they even say that [illegible] at that time [illegible]

The furnace is 4 ft 3 by 3 as they told me, and by Mr. Malachi's measurement of my sketch the mouth width at the tyer 3 ft 4 the inside 2 ft 9 in and below at the tuth 3 ft and the inside 6 ft

[illegible] there are [illegible] carbonic. The furnace house, bellows and [illegible] and the operation are [illegible] there at Sauzara, and my very best [illegible] about 4 ½ Weeks in the evening [illegible] by [illegible]

Coal [illegible] Mr. Malachi [illegible] [illegible] [illegible]

Mechanics.

2 times in the day time and about ten times in the night. On the first day the Cooling is longer and the cooling less frequent; on the third day, more rapid and more frequent. They change about once or twice in a minute; that is about once in a minute.

Reading of the Thermometer. Inside the furnace Regulator, what we call the Iron outside of the Regulator is divided by the black rules into twenty equal parts (about three feet and six inches) each of which represents about one degree.

The iron rod is charged only about the middle of the afternoon, and is charged usually about the middle of the afternoon. The rod is charged about the middle of the afternoon. The rod is charged about the middle of the afternoon. The rod is charged

would seem to be impossible as the light Magnus rise above, the winds and coals often [illegible] become unusual dynamic; but it does not [illegible] the [illegible] of the [illegible]

The [illegible] in the [illegible] is [illegible] (a [illegible]) [illegible] already (2 [illegible]). The [illegible] [illegible] [illegible]

[illegible] 720 x 20 Ramm [illegible]
and 1200 x 1334 Ramm [illegible]
and 2000 Ramm [illegible]. [illegible]
[illegible] [illegible]
[illegible] [illegible]
[illegible]

alone in the Bingo process less charcoal is needed. The Kizo are about 20 (18 to 21) on each side of the furnace and are a little smaller than for the making of steel. The dzuku is drawn off in a melted state by the holes at the end of the furnace. In other respects the Bingo process does not specially differ from the Idzumo.

Remarks.

The whole cost of the steel and iron product appears to be made up mainly in the following proportions:

Charcoal		45 1/4 percent
Ore		37 1/4 " "
Furnace:		
Clay	4	
Wood for drying	3 1/2	
Labor	1	
		8 1/2
Labor:		
Breaking	3 1/2	
Blowing	2 1/3	
Charging	1 1/6	7
Wood for ashes		100

Evidently the cost of fuel and ore are for the most important items.

Much economy might apparently be made in the operation of iron and steel making:

1° By a cheaper method of washing the ore.
2° " " " " " carrying ore & fuel
3° " " " " " fluxing.
4° " " " " " furnace building
5° " " " " " blowing.
6° " " " " " breaking up.

1° The ore could perhaps be washed from the hillsides more cheaply by the California hydraulic method than it is now washed by hand.

2° The cost of carrying the ore must be at present an important part of its final cost; and with good wagon roads or with navigable streams the cost of carriage would be much lessened. It may very well be that the iron industry alone is not of sufficient importance to justify a great outlay for the improvement of roads; but better roads would be a great advantage, directly or indirectly to every inhabitant, no matter what any occupation

the farmer would waste far less of his time and labor in carrying his produce to market; the iron maker or merchant would lose less in carrying his iron to a better market; the laborer would be able to buy food and the comforts of life ~~xxxxx~~ somewhat cheaper, and with the same wages he would be better off, or would be as well off with lower wages."

The ore at present brought from a distance to the Amegawa furnace is before using reduced by washing to one half its weight. If the final washing were done before carrying, the cost of carriage would be reduced one half.

As the fuel at present weighs fifty per cent more than the ore of the last washing, it is desirable to carry the finally washed ore to the neighborhood of the fuel growing places rather than to carry the fuel to the ore. But fuel can be floated down stream on brooks that would not carry a boat for the ore. Never the less, as ore could be carried very cheaply down stream in boats on the larger streams (with improved navigation) it would seem advisable to have the iron works some distance down stream in the larger valley

near good water power rather than far up in the narrow valleys among the mountains where the supply of fuel would be comparatively small and the water power trifling. ¶ It doubt a considerable saving in fuel could be effected by the use of a hot blast; for a heated blast is especially economical with low furnaces. The fuel required for heating in a simple apparatus is much less than that saved in smelting.

It is not improbable that in places near the sea shore coke might advantageously be used instead of charcoal; but the quality of the iron would in general be inferior. As the heat produced by it would be greater the width of the furnace might be lessened, or a larger quantity of ore might be charged in the same time. It would however be necessary to use a stronger blast.

3°. The steel and iron produced amount to only one fourth or one third of the whole weight of the ore; while the pure ore contains nearly three fourths its weight of iron. The loss of iron in the process, then, is very great, as it is also in the Catalan method. The

iron goes into the slag; for in order to separate the particles of quartz in the ore it must be made fusible by combining with the oxide of iron to form a glass. The clay (silicate of alumina) of the walls of the furnace combining with the quartz and the oxide of iron form a fusible double silicate of alumina and protoxide of iron, also at the cost of iron. In ordinary blast furnaces of western countries limestone is charged along with the ore (which generally contains clay also) in order that a double silicate of alumina and lime may be formed in which the lime takes the place of iron and so prevents it loss. Perhaps limestone might also be used to advantage in the Japanese furnace. Probably the ashes used serve also as a flux (Tennant of no other use for which the could be specially needed); but it is a very costly flux. Many plants contain lime or alkalies especially potash in their ashes; but I am not yet a [illegible] precise composition of the ashes of the make. It is known however that the ashes of fir wood (to which the make is nearly allied) contain a

larger proportion (about one pound) to [illegible] (about one pound) to [illegible] [illegible] [illegible]

before charging; so that the heat of the furnace will not be lost in the calcination of the limestone, and the lime will be ready to combine with the silicious and agillaceous matter as soon as it reaches the point (near the bottom of the furnace) where the heat is sufficient. In the high furnaces even the separately burnt lime has by some iron makers been found advantageous. If the lime were burnt near the quarries, there would be a savings of about one third in carriage, a point of great importance with the present bad roads where waggons cannot be used. The lime should of course be used as freshly burnt as possible before it takes [illegible] acid again from the air. But in any [illegible] the lime would be a cheaper flux than the ashes now are.

It is impossible to tell precisely the [illegible] suitable quantity of limestone to charge without knowing more exactly the composition [illegible] and (if the kama be built of clay) without knowing how much of the clay will [illegible] the descending burden of the furnace. It would take perhaps only about twelve hammer

Iron Hand Wash Stand

Kisuki Iron Finery.

In Kisuki, on the east side of the [illegible] ri northwesterly from Minari and five ri northeasterly from Smaichi, there is a small forge for converting dzuku and kera into wrought iron bars. As I passed through Kisuki in the afternoon, and as the forge works only in the forenoon, I had no opportunity to see the operation myself; and was afterwards disappointed in the hope I entertained of seeing the whole process more conveniently at some other place. Nevertheless I saw the fire places and tools at Kisuki and obtained by inquiry that information I could (though imperfectly) in regard to the details of the method followed.

There are two forge fires, each under a hood about 3½ feet square that tapers from four or five feet above the ground upwards into a low wide chimney, of which below the hood there is only the back wall and the right side. Behind the back wall there is for each fire a wooden box hand bellows with a piston and horizontal rod like the bellows of all Japanese forges. The fire is a bloomary for reducing the dzuku apparently to [illegible] and the other fire is a [illegible] for making [illegible] from

these blooms and hera by reheating and welding. The bloomary fire place or hearth is a trough like space three feet long (at right angles with the back wall of the chimney) 0.6 deep and 1.5 wide at the top and one foot wide at the bottom. The sides are made of iron plates about 0.06 thick; and the bottom slopes slightly forward. The tuyere (or hire) enters from the bellows through the chimney back at the back end of the hearth and at the bottom of it and is level, and reaches forward to 1½ ft from the chimney back. That portion of the hearth was at the time of my visit full of forge cinder (kanakuss). The chafery hearth is 3.25 long nearly at right angles with the back of the chimney, 0.85 wide (both at top and bottom) and one foot deep at the deepest point, which was about the middle of the length. The hire just reaches to the hearth at the back and is level; (and has a diameter of 0.15 ft inside and is 0.015 ft thick (of bamboo covered with clay?)

The furnace and forge work lasts from midnight until noon. Charcoal is first charged upon the bloomary hearth, and upon that about seven damms of stuku; and then the blowing is begun. In about an hour a lumpoo bulk is formed; which is hammered into a bloom, and

put with about the same weight of Kera into the chafery fire. Each day eight blooms are so made, and that work is completed before any of them are reheated in the chafery. The bloom and Kera of about the same weight are put together into the chafery fire and are heated and hammered repeatedly until bars are formed. The bars are 1.8 or 1.9 ft long by 0.4 ft wide and 0.03 or 0.04 ft thick, and weigh five fourths of a Kamme (or about 10 lbs) each. After the first [illegible] the lump of about five Kamme is cut into four parts with chisels and with four men striking with heavy hand hammers on a small anvil set in the ground. During the heating in the chafery fire, hot and melting Cinder (Kuso) runs out and is drawn off from the front of the hearth. Each day eight shoo of charcoal are used in the chafery fire. A shoo is a measure of cubical shape two feet and a half long on each edge, and a shoo of charcoal weighs about fifty Kamme, and costs at Kimbe about twenty sen. As I understood, one shoo a day is used in the bloomary fire for making the eight blooms. In all there are eight workmen: two for the bellows, four for striking, one for holding

the chisel and one for attending to the fire. In one day forty kamme of finished bars are produced. As was stated at Amegawa, the cost of converting dzuku and kera into bar iron is $2.70 a load (probably of 30 kamme of bars, or $3.60 for the daily product of 40 kamme of bars). If from the $3.60 we subtract the cost of the nine shoo of charcoal, $1.20, there remains $1.20 which divided among the eight men would be 22½ sen for each man, or just about the wages that are earned by miners. Apparently the forge owner makes no [illegible] profit, and it is not likely that he should, for his work requires no great capital that would tend to prevent competition.

The amount of charcoal consumed at Kisuki seems to be enormous, no less than eleven times the weight of the bar iron produced; whereas in very closely similar methods in western countries, only one and a half or three times the weight of the bar iron is needed. In Japan, too, the loss of iron in fining the dzuku and kera, 57½ per cent, as stated at Amegawa, is very large indeed. It may be, however, that the dzuku and kera are very impure, so that the [illegible]

in weight may not by any means be [illegible] a loss in iron. The method practised at [illegible] in the whole a bad one; though in [illegible] puddling is more economical from the possibility of using inferior fuel and its [illegible] less skill in the workmen, but needing better roads than now exist in Japan, for more convenient concentration of materials and working on a larger scale. It seems however desirable that the Kisuki method should be improved [illegible] so as to increase its economy. But it must be borne in mind that the information we have about it is yet imperfect and perhaps in some points mistaken and incorrect.

feet high above the water. The shovel is about two feet long and a foot wide with the edges raised about 0.2, but with the back as well as the front open, and with a long handle. The shovel is moved upstream or sometimes sidewards, ~~xxxxxxxxxxxx~~ into the sand of the shallow stream repeatedly until filled with satisfactory material, and is then dragged along the bed of the river in the water to the heap, where it is emptied upon the top and all the last grains of sand are carefully washed out. The washer moreover while standing at the side of the heap is dipping up water with a large dipper formed of a bucket about a foot in diameter and depth and with a handle three feet long attached to its bottom and in the same plane with it; and is pouring the water on an upstream edge of the heap a little to one side occasionally with a wooden hoe he rakes down the upper part of the heap towards the point where he is washing. The lighter worthless sand is thus carried away into the stream while the heavier iron sand remains.

The washing seems to be very profitable, as wages are in that region. The quality of iron sand, as

already mentioned at Amagawa is not so good as that washed directly from the rock, [illegible] fusible, and is still more inferior to the ore taken from alluvial ground. Probably by the natural rubbing of the particles against each other in the river the weathered, more fusible outer coating or film is constantly removed from the grains, so that the remaining particles are of a less fusible character. Even in the solid rock there is no doubt a certain amount of weathering constantly going on by means of the air and moisture that penetrates by the minute fissures and pores of the very crumbling mass. But in alluvial sandy ground such weathering, slow as it is, becomes somewhat more complete, and the resulting reddish perofidised iron remains which no doubts gives its name, "akome", to that kind of ore.

A good deal of space has been given in these notes to the subject of iron, because it is not unlikely to become far the most important mining question of all Japan after that of the coal fields of Yesso.

Ottatsu Copper Mines.

The Ottatsu copper mines in Idzumo are within a few hundred yards of the east bank of the Kando River near the village of Ottatsu at a point called two ri and a half by river or two ri by land from Maki (which is about half a ri from Imaichi). But the river is so difficult to ascend in a boat that the voyage upstream requires six hours and a half to the village of Ottatsu; though it takes but three hours to return down stream. The road by land passes over high hills, and is said to be extremely rough with stones.

The mines were first opened in the Fourth Month of 1875; and were abandoned as unprofitable in the Spring of 1879. The rocks of the region I took to belong to the Kamiskotan group. There are said to be three mines and two veins. The veins are admitted to have been too thin to work with profit; but the miners were always in hopes of coming upon some wide vein of which the two were supposed to be mere branches. They said that some foreigner, who in passing visited the place,

encouraged them in that belief; but I do not know of any grounds for it. The owners are anxious to borrow money from the Kanakas in order to carry on the mines; and for that reason are very anxious that visitors should come and make a favorable report. I see no reason whatever to believe that the mines or veins would be any more profitable in the future than they have been in the past. The most thorough way of testing veins, though the costliest, is the one they have tried for three or four years by digging upon them; and the probability is that the same number of years more of digging would meet with no better result. The owners' strong belief that the mines would improve on further exploration is merely an instance of the hopefulness of human nature that is too frequently displayed at mines to weigh very greatly as an argument towards convincing any body that has had much experience in such matters.

In 1875 they began mining in the 4th month. up to 30 June they produced 2213 Kamme of ore, and 435 Kamme of Copper.

1 July to 30 Sept. 1875:

Ore mined	1303 700	Kamme.
" Smelted	2251 000	"
" Remained	1265 700	"
Copper made (2 1/3 %)	447 900	"
" Sold (for $773 025)	883 400	"

Days:

Mines	117
furnaces	47
	164

Days' work:

Mines	3119 5
furnaces	1609 184
	4728 684

Expences:

Mines	$1338 70
furnaces	1093 683
	2432 383

Tax $1 018

* Some specimens of ore were shown; chiefly copper pyrites with cubical iron pyrites, and one with zinc blende. One piece of fist size had much malachite on the copper pyrites; and that is said to be the last worked and the best discovery. The gangue is gray quartz.

1 Mule $30 [illegible]

Che Previous ——— 1303 22 Remains.

" Invoice ——— 251 00

" Insurance ——— 125 20

" Commission (2½%) ——— 44 32

" Office Rent ——— 8 83 00

Sales:

Invoice ——— 117

Returns ——— 47

164

Purchases:

Invoice ——— 3114 [illegible]

Returns ——— 1[illegible] 00

4[illegible] [illegible]

Expenses:

Invoice ——— [illegible] 38 [illegible]

Insurance ——— 1[illegible] 00

[illegible] [illegible]

[illegible]

[illegible] [illegible] [illegible] [

From 1 April to 30 June 1877:

Ore on hand 1 April	1680.000	[illegible]
" mined	1250.000	"
" smelted	1484.000	"
left on hand [illegible]	[illegible]	
Copper made (15%)	193.200	"
" left on hand [illegible]	19[illegible]	"

Days:

mines	91
furnaces	76
	167

Days' work:

mines	[illegible]64.5
furnaces	1105.0
	3369.5

Expenses:

mines	$ 5[illegible]
furnaces	3[illegible]
	845.2247

Tax 1.0180

From 1 July to 31 December 1877:

Ore on hand 1 July	1446.500	Tonnes
" mined	2536.000	"
" smelted	2427.000	"
" left on hand 31 Dec.	1549.500	"
Copper on hand 1 July	175.000	"
" made (12½ %)	304.000	"
" sold (for $496.000)	496.000	"
" left on hand 31 Dec.	59.000	"

Guys:

Mines	183
furnaces	181
	364

Keystrokes:

Mines	5084
furnaces	2856.45
	7940.45

Expenses:

Mines	$1405.[illegible]
furnaces	770.[illegible]
	2175.[illegible]

Tax [illegible]

[illegible] Jan. & 31 March, 1878:

[illegible] on hand 1 Jan.	1847.500	[illegible]
Mined	1620.000	"
[illegible]	2715.000	"
[illegible] on hand 31 March	454.500	"

Copper (the amount on hand 1 Jan. 57.000 [illegible] from the table)

made (13%)	352.000	"
Sold	240.000	"
left on hand 31 March	112.000	"

Days:

Mines	117
furnaces	55
	172

Days' work:

Mines	[illegible]
furnaces	[illegible]
	[illegible]

Expenses:

Mines	$ [illegible]
furnaces	[illegible]
	[illegible]

Pay

Udoo Copper Mines.

The Udoo Copper Mines in Idzumo are about a ri and a half north of Kidzuki, and about twelve chao southeast of the village and small seaport of [illegible], and about two feet above the sea.

The mines are on the southeast side of a hill that rises a couple of hundred feet higher and separates them from the sea there. The whole place from near Kidzuki to the mines and northeastward is very hilly and mountainous, forming the southwestern end of a high range from near [illegible].

The rocks of the region seem to be ancient greenish gray metamorphic shales, [illegible] which I have reckoned as a part of the Kamaikoku Group. In some places near the mines the rock is very much impregnated with cubical iron pyrites in minute crystals. The rock is very felspathic and in parts rather bright green and apparently talcose.

There is said to be just one vein in the mines at present worked, though there is said to be another worthless vein on the road about two

It is clear from the tables that, while in the year ending 31 March, 1878, only 848 [illegible] Kamme of copper (evidently all arados), work about $848, were made, these were expensed (including taxes) to the amount of $3701; so that there must have been a loss of about $2853. The tables, however, are evidently not quite without error; [illegible] there may possibly be some mistake in the statements by which it appears that the furnace work (including the ore washing) required in 1875 about [illegible] days work to the hundred Kamme of copper produced; in the spring of 1877, about five days and a half; in the last half of 1877, about nine days and a half; and in the beginning of 1878 only a little more than two days!

[illegible] and there was no ore. The [illegible] in length [illegible] had no ore. The [illegible] fathoms contains [illegible] ore, and has been worked [illegible] about [illegible] fathoms towards the [illegible], less towards the southeast, without coming to an end of the ore. The ore is copper [illegible] and the [illegible] part of the vein [illegible] with [illegible] copper pyrites, which is abundant [illegible] at those parts of the vein where the copper ore is [illegible]

The ore contains, it is said, a little [illegible] in a hampe of aradoo & 6.4 or 6.5 [illegible]

[illegible] ore. [illegible] the [illegible] is [illegible] as little as possible.

The mines have been worked only [illegible] since 1861 [illegible] an old abandoned drift of [illegible] ten fathoms in length on the road about [illegible] [illegible]. There are [illegible] [illegible] in the Nanaimo, the northernmost [illegible], and one, the Rigorgan, [illegible] only one not worked, in the southeastern end. The Nanaimo mines were worked half a dozen years [illegible]. Formerly the Rigorgan had not been begun. The [illegible] of the Nanaimo covered a space of [illegible] hundred fathoms in length and

down by the pail; and the cow is evidently very difficult, and the pulse is hard and frequently rebated. At about one hour of their time, when the cows are in the act of drinking, it was found 5 strokes a minute. Many an hour after the pulse had reached 60 strokes in a minute, the pulse of the cow was then reported to have exactly the same number of strokes (about 60) and the cow was found to be in the act of drinking. The cow was then taken to the stable and the pulse was found to be 60 strokes in a minute

[illegible] you [illegible]
[illegible]
the hearth. [illegible]
[illegible]
water. In one case that [illegible]
[illegible]
[illegible]
[illegible]
was removed; [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
They are of about the same size and shape as those of Adelaide
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Carte ea.

Numerari ——— 5 Pieces

" ——— 25 "

Nuove ——— 24 "

——— 53 "

Contrassegni ——— 16 diversi

(Vedi rispettivamente)

In the office ——— 13 men

" " Yard ——— 3 " "

The Canal Guard consists of [illegible] men [illegible] Each [illegible] men [illegible] Each Station [illegible] Each [illegible] has a Station House. The Station House has [illegible] Each [illegible] is provided with [illegible] Each [illegible] has [illegible] Each [illegible] has [illegible]

The Basin Captain is paid 2[illegible] a month. The Lockmen, 1st Class, get [illegible] a month, 2nd Class, $[illegible], 3rd Class, $[illegible]. They receive each month 3 lbs of tea, 10 lbs of [illegible], and [illegible] of salt. [illegible] They receive [illegible] during [illegible] a year. [illegible] 13 [illegible] [illegible] [illegible]

and a reward of three sen is given for every ten kaddams of ore. On the other hand the kanchori have their wages cut down according to the number of days lost, which are counted up every two months.

The kanchori aids get daily in money:

1st class —— 10 sen;
2nd " —— 9 "
3rd " —— 8 "

and 10 sen down to 3 sen a day for small children. Each of them also receives daily 9 goo of rice down to 8 goo for children; and monthly one shoo of oil.

The ore washers get daily in money:

1st class —— 10 sen,
2nd " do —— 8 " and 7 sen,

and all have each one shoo of rice a day.

The furnacemen (darkin) get daily in money:

1st class —— 20 sen;
2nd " (including the oil man) —— 15 sen,
3rd " —— 13 sen;

and each of them has one shoo of rice a day.

The coolies get 15 sen a day without rice; if one shoo of rice a day is advanced to them they get in addition 7 or 10 in money.

The cost of mining a given bulk of country rock or of vein stuff is not known as the wages are always paid by the time and no measurement of bulk is made.

I recommended that first of all a careful geological and topographical survey should be made of the whole neighborhood of so prosperous and promising a mine; and that research a survey should make it seem probable that the southeasterly ore shoot, the one now worked continuous (unlike the northwesterly one) to a considerable depth, as seems now most likely, they should make a drainage level from near the sea shore, somewhere near the village of Pagi, or from the bottom of the valley that has its mouth there; and that they should arrange to remove the smelting works to some place near the mouth of that level. The amount of ore that can be mined without pumping would thereby become as great as possible; the cost of wood and charcoal would be reduced very much; and the nearness to the little harbor of Pagi would in many ways be extremely convenient. As the vein fortunately dips in that very direction the

distance & it at sea level would be more valuable than it is in a low light house & the general [illegible] (probably not more than 40 or 50 miles); and any lighter vessels & the ships with passengers would be still nearer to the land and thus would find the signals already in various ways. The Board [illegible] would perhaps suggest and means of trading like &c; and possibly [illegible] by [illegible] the [illegible] and the [illegible] [illegible] [illegible]

Iwami Ginzan.

The Iwami Silver mines are at Ginzanmachi, which is within the lands of the village of Omori, and on the main road about 12 ri from Hatsuda, about 3½ ri from Oda, and about 13 ri from Hamada.

The mines are among the hills a couple of ri from the sea shore, just north of the main hilly ridge between Oda and Iwami, and the village of Ginzanmachi is some 500 feet above the sea. The main road crosses that rise some 250 feet still higher; and the mines extend still much higher and probably much lower than the village; in all through a vertical space, it is said, of 150 fathoms.

The rocks of the region are old volcanic trachyte, in some places decomposing and containing alum, in others hard and with dark brown or bronze colored mica and with a very little hornblende and chiefly composed of a rather light gray granular fine grained rough [illegible] including also larger crystals and grains of [illegible]idin, and with here and there a [illegible]

Chapitre premier.

yellow grain of iron pyrites. The volcanic rocks are probably connected with Sambi Mountain, a rather fresh looking extinct volcano, which is only some five ri distant in a straight line to the east.

There are said to be about thirty veins, all running about east and west; and towards the east the country rock is harder and the veins narrower, half a foot to one foot at most while towards the west the rock is softer and the veins wider, and still westward again the rock changes and the veins run out. There are (it is said) many veins that are half a foot or one foot wide, but three that are much wider. One of them is said to be three fathoms wide; another one fathom; and the third about three feet. The greatest width of the now worked is said to be about half a fathom; but the best specimens shown me (from the Shinkuchishike mine) indicated a width of [illegible] of copper pyrites; and in another case (from the Shoorengi mine) a width of [illegible] of copper pyrites about half filled with [illegible] there were said to be another corresponding layer of like thickness on the other side of the vein. Specimens

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but it is commonly not separated. The vein rock is in general harder than the country rock.

The mines were begun in the epoch Taiei (some 600 years ago), and have been worked continuously ever since. They were especially flourishing in the Keichoo epoch (some 300 years ago); and are said to have yielded their 3000 kamme of silver (over half a million dollars) yearly for four years, and 3000 kamme and 2000 kamme a year for a long time. But the ore above water level has been gradually exhausted; and in the great earthquake of half a dozen years ago so much money was lost in the region that capital has been lacking to work vigorously the small and even larger places above water level that are believed still to contain good paying ore. There is therefore a strong desire to borrow money for the purpose from the government. The mines at present are worked by two individuals or separate firms or companies. One is Mr. Adachi Soemon, who has worked the mines since 1874, with furnaces a couple of hundred yards off the main road at Ginzan machi. The other consists of three men: Messrs. Hoyama [illegible] Sakahashi

a cotton dress.

At the Mission Village, and visited in the afternoon several of them at their houses, but all present only one a very small room.

The premises of the Missionaries are quite separate, but the buildings on the ground are [illegible] Village. All the [illegible] are [illegible] and [illegible] [illegible] [illegible]

[illegible]

[illegible] there is still another process called the [illegible] in which they charge as much as 25 [illegible] here

[illegible]

[illegible] [illegible] [illegible] [

copper remain in the form of sinder and are smelted again in the ginganbute [illegible] [illegible] about eight hammer at a time.

The second part of the second operation was witnessed by me from four o'clock by my time, when they had just melted the 1½ hammer of litharge until the close at 5:30. The workman used two tools: one was a small light iron hoe about 0.3 broad and 0.08 deep fixed perpendicularly to the end of a flat iron rod about 0.1 broad and about two feet long joined [illegible] to a slender wooden handle about four feet long. The other tool was a billet of wood about 1 long (about a foot long when new) and 0.35 wide to the top of one end of which is joined lengthwise a light iron rod about 2½ feet long, with a wooden handle about 3½ feet long by striking with a hammer its somewhat sharpened rather hook shaped point into the billet. The workman's face is protected somewhat from the heat of the metal on the forehearth by a veil that hangs about a foot before his eyes from a slight wooden frame that is bound to his head.

Portions of the melted mixture of copper-lead

At 5.30 the [illegible] ended and early the men
[illegible] in the furnace when many
the coals from the second part.

The [illegible] (crystallin) [illegible]
[illegible] Mr. Galachi's [illegible]
a very small [illegible] and the men [illegible]
the [illegible] of iron [illegible] by one [illegible]
of the [illegible]. The [illegible] with close
beside the [illegible] with, one end of [illegible]
[illegible] ground, and was about one foot in diameter
at the [illegible], about 2' 3" high and with a hole
about half a foot in diameter at the top. Into
[illegible] a gentle blast, given by a [illegible] of
the usual shape but very small, only about
9" long, and worked by [illegible] hand. At 7.45
they [illegible] the coals from the [illegible] and
immediately afterwards they covered with [illegible]
[illegible] [illegible], which was a thick about 6" to 15" in
diameter and [illegible] 2' 6" to 3' thick, and was thought
to [illegible] 30 cwt.

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible]

9

[illegible]

[illegible]

[illegible]

Expenses:

mines	$255.[illegible]
furnaces	130
	385.[illegible]

Tax — [illegible]

From 1 Jan. to 30 June. 1878:

Ore on hand 1 Jan.	400 Kammer.
" mined	5579.300 "
" melted	5479.500 "
" left on hand 30 June	700 "
Copper made (6%), and sold got $37.[illegible]	[illegible] "
Silver made ($\frac{1}{10}$ of 1%), and sold got $[illegible]	5.[illegible] "
Mark, sold got $1129.[illegible]	3[illegible].[illegible] "

Days:

mines	163
furnaces	120
	283

Days work:

mines	1956
furnaces	960
	2916

Expenses:

mines	$667.[illegible]
furnaces	[illegible]
	957.[illegible]

Tax — [illegible]

[illegible], at the upper place:

Koofu	[illegible]
Furnace men (including [illegible])	[illegible]
Office	5 "
	40 "

[illegible] at Mr. Adachi's place:

Koofu	[illegible]
Furnace men	7 "
Office	3 "
	22

Prices;

100 Kamme Wood (from up to man)	22 & 23 mm.
[illegible] Charcoal (from [illegible] 3 to [illegible])	55 "
1 [illegible] Ashes about	2 "
1 day Koofu's wages (money without rice)	[illegible] "
1 " Furnace man's " " "	[illegible] "
1 " Woman's wages (for washing) " " "	[illegible] "

The wages are low but it is hoped to do better when the mines get fairly to work.

To mine a length of one [illegible] (five feet), by [illegible] (or [illegible]) in width and [illegible] in height costs in the hard places in the vein [illegible]; in a soft place six [illegible]; in the country rock about six [illegible]; including the cost of [illegible] and oil

[illegible] the present [illegible]
[illegible] [illegible] by the table. [illegible]
probable that the [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible]

that was given [illegible]; but apparently no surveys at all have been made yet.

Mumioi.

At the Ginzan mines there is said to be found a red powder, that is separated from its impurities by washing, and sold at a high price as a medicine under the name of mumioi, especially as a styptic for stanching bleeding wounds. It is a pulverulent red osmacite (peroxide of iron).

Arsenic.

Formerly arsenic (nedzumitoi kusuri) was found at the Ginzan; but for some time none has been produced.

Nishida Alum.

At Nishida, about a ri from the Iwami Ginzan towards Hamada, some specimens of "alum stone" were shown me that were said to have been taken from a place about 18 or 20 choo northeast of Nishida village. It was said to be found in hole about one foot in diameter in a rock as big as a house. The brown crumbling powder of the stone is said to be used instead of alum, and has its taste. It appears to be a decomposing trachyte.

Nishida Coal Tracts.

About ten choo forward from Nishida on the Hamada road, there is, close by the side of [illegible] water closet and a little east of a low hose in the hills, an exposure of about a foot in thickness of quite unworkable dark grey [illegible] carbonaceous, heavy shale, or extremely impure lignite. It dips 20° S 60° W. It is probably of about the age of Tochibets Group.

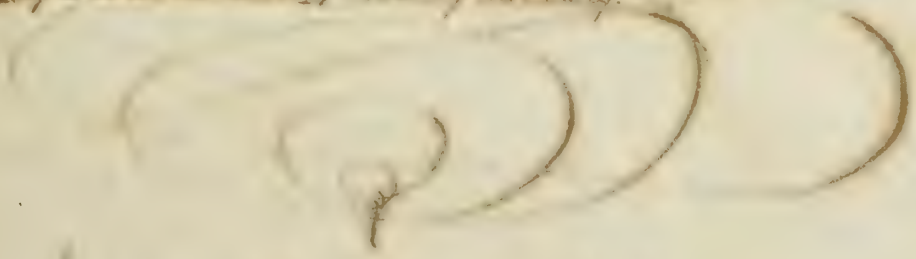
Zoomchi Copper Mines

The Zoomchi Copper mines in Nagato are [illegible] from Tahanom on the road to Nagi. [illegible] told at Shimonoe in passing that the copper (apparently arabic in large, round [illegible] with [illegible]) was sent out by that village on the way [illegible] to Oosaka, and that there were about fifty loads of it a month, amounting to about [illegible] hammers. They said [illegible] late had been more abundant than formerly, and the product consequently greater; but that the working of the [illegible] had been abandoned.

Naganoboli Shirome.

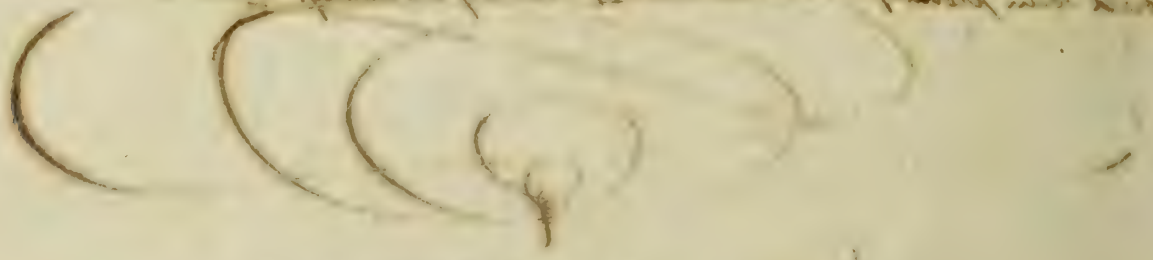
At Naganoboli, in Mimasaki, Angelo found a mineral that in its weathered [illegible] was shown to me and in that condition an earthy or stony brown hematite, and I supposed it [illegible] much weathered magnetic pyrites. It is said (by the officials at Tamagachi) to be in great quantity enough to fill the town of Tamagachi, in mine up to three fathoms in width. They say that it is smelted 40 kamme at a time in a hearth, like the copper smelting hearth, with charcoal, producing a liquid metal below, called shirome, [illegible] eight kamme, and becomes on cooling harder and closer grained than iron and slightly reddish in color, becoming green in rusting (perhaps from copper). It costs less to make the metal than it does to make iron. It is used but little yet and there is no great demand for it; but it is thought that it would do for many kinds of pots, [illegible] and the like. It is now chiefly used to mix with copper at Osaka to make a spurious [illegible] as it gives a black color to copper, which however

[illegible] in a day or two as the genuine Shibudoo
the metal was used for making bullets [illegible]
[illegible] The mineral [illegible]
through copper ore ([illegible] malachite) which [illegible]
called Shirome doo. Traces of malachite are wholly wanting
in the weathered specimens [illegible]. [illegible] mineral [illegible] and I am uncertain about the nature of [illegible]
without a chemical analysis. As this and at Ozaka [illegible] as other [illegible]
would seem probably to be the same thing, namely [illegible].



Auganobori Copper Mine.

At Yamaguchi they showed us also some specimens of copper ore from the [illegible] village of Auganobori. The ore is in part green malachite but in part blue chessylite, partly in minute crystals (both carbonate of copper); also there was some Shirome doo. The place, as we understood, was an old abandoned mine now tried again a little.



Yamaguchi Hot Springs.

In the western edge of the [illegible] of Yamaguchi there are some hot springs, seven in all, with as many baths, within a space of perhaps [illegible] yards in length. The temperatures in the baths, over the points where the water [illegible] from the alluvium, were 42°, 43°, 45°, 44°, 45°, 46°, and 51°C. (at 107°, 109°, 111°, 113°, 115°, and 124°F.) The water smells decidedly of sulphuretted hydrogen, and accordingly colors [illegible] black quite strongly. The quantity of water that [illegible] appears not to be very great, and the baths (about 5 feet by 4 feet by 2½ feet deep) are emptied but three times a day (at 6 A.M., 11 A.M., and 5 P.M.). In one bath (about 4 ft. by 3½ ft. by 2½ ft. deep) where the water is raised by a pump from a well nine feet deep, it takes about an hour of waiting when the well has been emptied.

Coal near Namur.

or Mashika, twenty five (in some places 35) feet below, with 2½ feet of coal exclusive of some refuse, (some said about 3 ft of coal and one of refuse). The distance between the beds of coal varies from place to place; and the quality of the coal likewise varies. Although the Mashika and Chingoo are the same bed their quality is different. The quality is said to be best [illegible] in Ariho and for a few hundred yards up stream; thence further up stream and down stream the quality is inferior. The Nakabori coal is rather worse than the Chingoo. Over the Nakabori there is said to be black hard stone, and for 30 feet in thickness the stone is hard. The Chingoo likewise is said to have a strong roof of hard black stone, and to have hard stone all the way up to the Nakabori. There are also some three or four smaller seams of coal that are not worked. The coal that I saw in the heaps at the boat landing in Ariho was poor looking, slate and small [illegible] looking, though there were many lumps a foot or more in size that seemed very fine. At [illegible] and at [illegible] [illegible] the Ranakoa said to be [illegible]

the same as the Chingoo, which it resembles) and the Hindoo about 15 feet below. The Ube coal is called better than the Chingoo, but the Onoda inferior.

The mines at Aribo are partly at least in the flat alluvial ground near the small river that flows past Funaki to the sea near Onoda. The mining is therefore carried mainly in the winter half the year, beginning in the middle of October and ending in April, when the paddy fields are not flooded. On the other hand, the carrying of the coal takes place in the summer season, while the mines are full of water; and mean time the coal is in piles in the open air. As the mines are below water level they have to be pumped, and Japanese pumps of bamboo are used. It is said that 5600 Kohu of water are raised a vertical height of sixty feet in one day by 80 men; that is, 70 Kohu to each man.

The Nashika and Ankaboi mines produce about equally, and both together about [illegible] picules (fuse of 16 kamme each) in a year. The Onoda mines yield about [illegible] picules, making about 400,000 picules a year for the whole product

[illegible] villages. [illegible] [illegible] [illegible]

Geological Survey of Japan

Continuation

of

Some Notes

on

Places of Interest

in the

Chiugoku

Prepared by Benj. Smith Lyman,
Chief Geologist, & Mining Engineer
of the use of
Messrs. Thomas and Co.
on their journey.
1879

Geological Survey of Japan.

Report of Progress for the year 1878, by Dr. John Milne, Geologist and Mining Engineer.

To His Excellency K. Inoue,
Public Works Minister.

Sir:

I beg to send the following report of the progress of the Geological Survey of Japan during the year 1878, its first annual report. My aim is to give here a short statement of the work that has been done and of the way the time has been spent by the assistants and myself; but to reserve the details and results of all work mainly for future special reports.

As already mentioned at the end of my report on the second year's progress of the Geological Survey of the Oil Land of Japan it was decided that from the beginning of February, 1878, our Survey should be made to apply to the geology of all Japan. Of course there was no expectation

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whatever in any quarter that the geology of the whole country could be thoroughly succeeded within a year or two; but I hoped that at least a useful, though modest, begin-in-might be made and that the new name and organization would serve well to reunite the varied geological labors of my assistants for many and many a year after my own retirement; since the work to be done is infinite in amount and necessarily can never be fully completed as long as mineral substances shall be mined or quarried in Japan. Neither the financial nor other circumstances of the empire made it probable that a very great annual outlay could for some time to come be applied to purposes that seem indeed rapidly to be more and more appreciated here, but that in spite of their great and manifold importance are even in western countries still thought worthy of absorbing only an extremely small portion of the whole national revenue. From like considerations it was also clear that we must give attention more particularly to matters of directly practical advantage than to those that were only indirectly useful [illegible]

very great weight in an educational or purely scientific point of view. It is certain too, that affairs that have a pretty direct utilitarian bearing give very ample scope for the exercise of the highest human faculties; and it may at least be questioned whether even so called "pure science" or "divine philosophy" would be anything better than the gratification of an idle curiosity or an opportunity for mental gymnastics were it not for the practical applications and benefits more or less indirectly brought about, yet more or less clearly aimed at or kept in view. Especially in a subject so novel to Japan as geology was it probably advisable to begin first with its more immediately useful branches trusting that their study and practice would soon lead to a higher estimate of the value of the more remotely advantageous ones. Our attention, therefore, has for the last half dozen years been given more especially to such geological surveying as would be a guide in regard to the working of mineral deposits as for example, the coal of Ikeso and the rock oil of Echigo and Tsotomi. There are however

many other minerals in Japan that have been and are well worth mining and for which such surveys would be extremely desirable as very greatly lessening at comparatively trifling expense the risks that are at best to a sufficiently high degree unavoidable. All those surveys can best be made by a single body of geological surveyors harmoniously working and conferring together and collecting as the sole receptacle for the whole country the numerous detached notes, facts and specimens that may from time to time be offered by occasional observers, official or unofficial, throughout the land, who are generally very glad to find a repository where such gleanings may be garnered up, and where they may be of great value as a part of the whole, though sometimes unimportant by themselves.

The aim, then, during the past year has been not only to carry on and if possible, finish the special survey of the oil lands of Japan but to complete the hasty reconnaissance of the whole country that had already been begun, with a view to [illegible]

of its general geological structure and particularly to ascertaining what places most needed detailed surveys, either for immediate mining purposes or for a thorough understanding of the position, extent and composition of the different formations, especially as regards useful minerals. Without first taking a general view of the whole country, it would be far more likely to happen that the relative importance of different regions should be greatly misunderstood and future work very disadvantageously planned and carried out. It was also possible that here and there some facts of immediate use might be noticed, and advice might sometimes be given on the spot in respect to mines or minerals. Indeed the eagerness to receive such advice was almost everywhere very striking, and it was much to be regretted that without detailed surveys and greater leisure desires of that kind could not be more fully met. It is yet quite possible, however, that in making separate reports on each of the principal places and regions visited a careful consideration of the facts observed and noted by myself

or recorded by others may lead to further conclusions and opinions of some value. Moreover, there is some reason to hope that from the notes of our survey and from various papers already published, and from a number of yet unpublished reports, notes and facts that have been collected in our office or in other branches of the government a general account of the geology, mines, metallurgy and mineralogy of all Japan may be prepared that will at least be much more complete and detailed than any yet made public, and that may prove to be of importance not only to the Japanese government and people but to the world at large, and may serve perhaps as a satisfactory case for future more thorough investigations.

The assistants of the Geological Survey of Japan have been the same that worked on the Geological Survey of the Oil Lands, namely:

Mr. T. Yamanchi, Chief Assistant Geologist.
" T. Inagaki, Assistant Geologist.
" T. Kawada, " "
" [illegible] " "

Mr. T. Kada, Assistant Geologist.
" S. Bun, " "
" J. Shimada, " "
" E. Yamayiwa, " "
" S. Maeda, " "
" S. Nishiyama, " "
" M. Maeda, Accountant.
" Y. Akiyama,
" J. Adachi, Clerk.

The two accountants have aided in the surveying and mapping in addition to their special duties. Mr. Adachi has during my journeys accompanied me, and has aided to some extent in the account keeping. The division of the assistants into parties continued the same as in the two previous years.

They have mainly confined their attention to the continuation of their work on the oil surveys, but in their journeys to and from Echigo have made such observations as they could without delay; and Messrs Kuwada and Nishiyama spent a day or two in surveying at the Akatani coal mines in northern Echigo. My own attention too while in the office was chiefly

taken up by matters connected with the oil surveys; likewise a part of the time while travelling, but the rest of the time by the more general reconnaissance.

I set out with Mr. Adachi for a visit to the Tootoomi oil survey on the 17th of April and returned on the ninth of May. On the 21st of June we started on a long journey (1126½ leagues, or about 2800 miles) first northward through Aidzu to the northern and middle Echigo oil surveys, and thence southward through Shikawaken, the Sanindoo, around Kinshiu, through and across Shikoku, through Kii, the Kishai, and back by the Tookaidoo. At the end of the year we had only reached Koochi in Shikoku, and did not arrive home until the third of February, 1877. In Echigo we visited the assistants at their surveys in Kambaragoori and afterwards assembled them all at Ossyama near Idzumozaki, where I worked with them for three weeks on the geology of their maps.

The assistants (except Messrs Suguira, Dan and Adachi) worked in the office until 28 May and then set out for Echigo, where they worked until late in the Autumn at the surveys and

mapping began by the different parties there in 1876. Messrs. Sugiura and Ban made a trip to the Tootoomi oil field from the 16th of April to the eleventh of June, to extend and correct their survey begun the year before; and after a fortnight more spent in mapping their work in the office here set out for their Echigo survey on the 26th of June. Messrs. Kada and Shimada returned from Echigo on the 17th of October, and the others in November; Messrs. Yamauchi, Yamaguwa and Mr. Maeda as well as Messrs. Sugiura and Ban, on the tenth; Messrs. Kuwada and Nishiyama on the 21st; Mr. Inagaki on the 24th and Mr. S. Maeda on the 25th.

Field work — Surveying — In 1876 the assistants had with almost uninterrupted fair weather done so much field work to the comparative neglect of office work that they had been unable in the short following winter season to finish the mapping so far as to have the geology studied out; and in the summer of 1877 they had been mostly occupied in adding to the extent of some of the surveys or in undertaking the

field work of new surveys in other regions, such as Tootoomi and Ahita. In the spring of 1878, however, we had undertaken to mark on the maps the probable geological structure and the outcrop of the oil bearing beds with the help of both the observed rock exposures and the very numerous well sections that had been collected together by diligent inquiry. But in 1878 on reaching Echigo again (and it was the same in Tootoomi) the assistants found that many of the statements in regard to the depth at which oil or certain rocks had been met with in digging the wells were very inexact. The length of the fathom had been counted differently by different men, and by the same men at the upper and lower parts of the same well; and many statements had been given with too great precision that were merely inexact remembrances of pretty old wells. It was therefore impossible to make so confident a use of the well sections as had been hoped, and rock exposures were sought out with renewed zeal and thoroughness, requiring much additional surveying. The early surveying (of 1876) was also found to be

in need of important correction in some places and a number of new lines had to be run with [illegible]. Moreover, a great many new wells dug in the two years (1876–78) had to be surveyed, plotted on the maps, and recorded as fully and accurately as possible. In a number of cases the depth of wells was tested and corrected by the assistants' own measurements.

Trial wells.— Our intention also at starting was, after a little addition [illegible] work and mapping, to test our geological mapping by some experimental digging, if necessary, and to give advice to the country people where they would best dig for oil; but owing to so many unexpected alterations in the facts on which our geological mapping was based we were not able to give such advice quite so soon nor over so wide a space as we had hoped. Nevertheless in the Idyumozaki region of Echigo and in Kamoaragoori the probable outcrop of the oil bearing beds has through a considerable space been marked out [illegible] the ground and a few wells [illegible]

been begun in accordance with our advice, and
now that have been dug deep enough to form an
opinion have been so successful as to inspire
the operators with far more faith in our survey
than they had in some cases at first. From
Tootoomi too word has come during the writing
of this report, that in the past year many
new wells have been undertaken, partly
according to our advice, and that the
result has much increased the confidence
of the larger and more intelligent operators
in the value of our work.

As the country people were almost every-
where eager to dig deep wells on their own
account wherever we should encourage them
to do so, it was unnecessary for us to undertake
any such expensive works merely for the
purpose of testing the geological structure and
accordingly the assistants did not at first
go beyond a little superficial digging to try
supposed outcrops or uncover imperfectly exposed
dip surfaces. After I had left Chigo however,
probably owing to an imperfect understanding
of the circumstances [illegible]

by the government to instruct the assistants to begin some deep wells; and the orders were insisted upon, in spite of my renewed attempts to explain the circumstances more clearly. Accordingly three deep wells were begun near Shyamozahi, and placed especially in charge of Mr. Ahiyama who on their account still remains in Echigo, and two of the wells have been remarkably successful. At my suggestion, however, the wells were at the end of January, 1877, quite removed from the Geological Survey and from my charge. It is my opinion that although the digging of oil wells is profitable to the country people, it can be (as shown in my report for 1877) but little so, if at all, to a mercantile company (even at higher prices for oil than those that have prevailed the past year), and on the average could only result in loss to the government. We found last summer in Echigo that the cost of well digging by a mercantile company as stated in my report for 1877 was one half greater than what it cost the villagers or farmers, and it is almost absolutely unavoidable that government work should be at least

twice as costly as that of a company. The government must pay higher prices for labor and materials, besides the salary and travelling allowances of an official for oversight and probably must besides sell the oil produced at a disadvantage. The country people on the other hand oversee their own work, can get labor and materials from their own families or land or can bargain for them at their own convenience, and have to pay no excessive prices. The produce of the oil wells is on the average so small that when the cost is trebled there must clearly be in general nothing but loss. There was, perhaps not unnaturally, some impatience to arrive at definite results from our survey; but there are already good direct results if our maps and advice can serve as a guide to the country people in digging their wells, and if we can prevent the waste of money by a government oil speculation that would probably be disastrous. Indirectly, lessened risk or increased certainty in oil well digging will be a good result to the nation in

diminishing the [illegible] supply
[illegible] and wealth of the inhabitants of the
Lagoons. [illegible] [illegible]
[illegible] [illegible] [illegible]
of the district) [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]

Improvement of Streets — [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible]

system of raising the water in a bucket. As the wells, however, are very narrow (about [illegible] feet and a half square), only one man can work in them at a time; and if his time is taken up in baling water, he cannot of course make so good progress in digging in the few hours when the daylight is sufficiently strong. A pump may therefore be at [illegible] convenience; and especially so if horse power or water power should be applied to that and other purposes connected with the well digging. It seemed possible that an iron bound wooden plunger pump with a light bamboo pump rod and a stout bamboo pipe tightly [illegible] with cheap country made cords might be strong enough to serve for raising the surface water from some little depth and it often penetrates only to a depth of ten fathoms; and it would have the advantage not merely of cheapness of first cost [illegible] of [illegible] simplicity of construction that it could be made and repaired by the country carpenters and blacksmiths. For a greater depth two or more separate lifts might be made use of. At

do not flow down idly to the sea, the winds does not blow uselessly, the tide does not rise and fall without good effect, the underground stores of coal are not left unburnt, and even the direct warmth of the sun is turned to account.

Office work.— Our time in the office during the spring was chiefly taken up in mapping especially in working out the geology with the help of numerous cross sections, as already described for the preceding winter months in my report for 1877. The accounts were also completed, as mentioned there, with a single-entry ledger. Between my Tootoomi journey and the long journey my time was taken up in great part by the writing of that report and getting it printed, particularly after the assistants had started for Echigo.

My Two Journeys— The Tootoomi Journey.— The journey to Tootoomi and back was described in my report for 1877. While there I spent a couple of days in visiting several newly discovered or newly tried oil places at least so called, namely: Ooiso, Ogami, Hirayama, Kurobe, Nakamishi, Hirai, Umakatatani,

Katarburga, Magdeburg, Nuremberg, Ulm, Augsburg, and several more of these [illegible] Though all not [illegible] Places of Art & [illegible]. Among the most [illegible] and San Sebastian Library [illegible] and numerous [illegible] of the [illegible] Sculptures. The city of the Emperors [illegible] Vienna with [illegible] [illegible] in the [illegible] of the [illegible] Imperial [illegible] [illegible] [illegible]

said to be some very interesting large limestone caverns, also we found in the metamorphic [illegible] rocks, but we did not delay to [illegible] them, as, as I possibly the cave as contained [illegible] human remains, as appear often in these [illegible]. As we [illegible] Kawaiki, we had since many hours seen no [illegible] [illegible] [illegible]

& the village of Ashio still in the midst of mountains, about 2000 feet above the sea again. The first league and a half or so was the road of the previous year to Chinzanji with exposures at Sachiishi of quartz porphyry. Another half league further on, near Hosoo village there were still exposures of the decomposing pumice but they were soon succeeded by somewhat similar looking ones of decomposing gray granitic sand; together with which was exposed in place here and there all the way to within half a league of Ashio village gray quartz porphyry with orthoclase (occasionally coarse) and, atleast in some cases, oligoclase and quartz, without mica, in a dark or light gray, sometimes dark green, matrix which is often so scanty as to give the rock at first night a granitic or syenitic look. The preceding year I had found river pebbles of a similar rock containing besides the two felspars and quartz in a scanty gray, matrix hornblende also, what might be called a syenite porphyry and it was said to occur in place about a league

down stream from Kogonnotaki. On the Ashio road a very few minute grains of yellow iron pyrites were seen in the porphyry I suppose all these porphyries to be ancient and to belong properly with the crystalline rocks hitherto classed together under the Kamoikotan Group. On the Chinzenji road I had also seen pebbles and exposures of hard blackish gray Old Volcanic rock, andesite containing much glassy triclinic feldspar (probably oligoclase), dark green pyroxene and magnetite in a grayish black matrix that was sometimes vesicular. On the way to Ashio village from half a league short of it and close up to the principal mines a league north the exposures were of black clay slate (sometimes with unperfect cleavage), like the slate near Kamaishi and elsewhere among Kamoikotan rocks. At the mines themselves however the rock is again the gray quartz porphyry, abounding with quartz in grains of pea size in a white feldspar matrix. [illegible] contains also many pea and bean size more or less rounded bits of black slate; a circumstance that was noticed too in like rock near Aosoo. Similar facts observed

elsewhere in the journey (see for example pp.) and compared with closely like ones recorded nearly forty years ago as occurring in syenite in my native region (see Hitchcock's Geology of Massachusetts pp. 669 and 677–9) where syenite has more recently been found to contain fossil trilobites, strengthen my suspicion that many or not all of the peritonic lookingrocks of the Kamoiklun group are in reality metamorphic.

The presence of the bits of black slate of course show that in any case the porphyry at the mines is newer than the slate that furnished the fragments; yet the slate that is exposed between the main village and the mines would rather appear to lie in the form of a sharp, narrow basin running northeast and southwest with the porphyry of the mines underlying it conformably on the northwest. But the dips are nearly vertical and perhaps sometimes reversed; so that the structure is a little doubtful.

The Ashio copper mines have been worked ever since 1610. They are in two groups, of

and run generally northeast

with a very little black oxide of copper

other names are all superior and only three of them are visited by the Hare, except a score of names which on their own accounts other Hares that are said to [illegible] a [illegible] of a [illegible] visit. [illegible] [illegible] [illegible]

of ~~crude~~ blister copper made in the last half of 1877 was 59827 lbs (44870 catties), which would have been 41 1/10 per cent. of the ore smelted in the same time (143917 lbs), whereas pure copper pyrites contains only 34 1/12 per cent of copper; and that in the first five months of 1878 the amount made was 48800 lbs (36600 catties) which would have been 28 1/4 per cent. of the ore smelted in the same time, a result almost equally improbable. At the copper mines visited by me in 1877 (Osaniguwa, Ani, Gusenji, Kanabira) where the ore is similar to that of Ashio and the same methods of washing are followed, the yield of refined copper to the washed ore smelted does not vary much from twelve per cent. It seems therefore quite probable that the yield of ~~crude~~ blister copper at Ashio in the first five months of 1878 may have been only the half of what is stated above or at most 25000 lbs (3000 kamme), about fourteen per cent. of the ore that was smelted. There are also several circumstances that confirm such a low estimate, and show too that the amount of blue vitriol made was only about half what was stated, or about 335 lbs

(400 kamme instead of 777 kamme) a month. The ~~[illegible]~~ blister copper was worth last summer (subtracting the cost of freight to Yokohama, fifty sen a picul) about fifteen dollars and a half a picul; and the blue vitriol about eight en and forty sen a picul. The income, then, for the first five months of 1878 after subtracting the outlay for fuel (which as near as could be ascertained was about $1150) appears to have been at the rate of about $541 a month or $6500 a year; and that divided among 300 men which must apparently have been about the number of workers employed (in a population of probably 450) would give them an average of only $1.80 a month.

Again, each miner is paid by the day in money twenty sen and in food the value of $6\frac{1}{5}$ sen; or in all $26\frac{1}{5}$ sen, and his tools are estimated to cost in addition six sen; making the whole day's work cost $32\frac{1}{5}$ sen, not counting powder and light and special rewards for good work. The carriers are paid in like manner the value of $16\frac{1}{5}$ sen a day. By the piece, as stated to me, ten en are paid in

comparatively [illegible] a length of
[illegible] and 2½ [illegible] a
[illegible] and in hard rock so as to
save [illegible] and in addition [illegible]
[illegible] and [illegible] are [illegible] as in the
[illegible] day. [illegible] [illegible] [illegible]
at least [illegible] and [illegible], [illegible] the
cost of [illegible] and the [illegible]. [illegible]
than the cost of [illegible] and [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] and
[illegible] [illegible] [illegible] [illegible] and
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]

to the picul) $5 \times 4 \times 0.25 \times \frac{1}{2} \times 250 \times 34\frac{6}{10} \times \frac{3}{400} \times 7 = 14.31$ in value of copper; and it would need a width of about half a foot of such ore to pay with the harder rock. There cannot in my opinion be the least pretense that a width of even a quarter of a foot would be maintained as an average of any large portion of the vein containing one half its bulk of pure ore even in the Ooyiri mine, much less in any of the others. It seems therefore quite sure that with present prices such thin veins in such hard rock cannot be worked with profit.

We returned to Nikkoo and sebout for Aidzu, passing through Inaichi again, and Ooyuna and Takatoku (five leagues from Nikkoo) of the preceding year's journey, and seeing near the ferry just short of Takatoku an outcrop of the quartz porphyry like that of the Ashio Pass. At Ooyuna we were told about some recent attempts to reopen the long abandoned Senoo copper mine in the neighboring village of Kobiyaku, and it appears that there had been found a width of about one or even up to $2\frac{1}{2}$ tenths of a foot of a mixture

of copper pyrites with some three times its very quantity of gangue that was partly kaolin; and a specimen of the ore was shown us. It is not in the least probable that such a thin poor vein can be worked with any profit in the very hard rocks of that region. The next day, several leagues further on a man brought us more specimens of the Senoo ore, and some of magnetic pyrites, of which he said there was a vein nine feet wide about a hundred fathoms from the copper mine.

At Takatoku we entered almost at once the mountains again, and kept on up the valley northward through Ohara and without crossing the river to see a [illegible] on the opposite shore. Takinoya in Takimura, which we heard of afterward as very hot, but without taste or smell and apparently very pure water through Tujiwara (near which many holes for ore were dug about a hundred years ago) to Sakahara, where we saw on the opposite river bank the Kawaji hot springs. The temperature of the main spring is 140°C., and the flow perhaps a cubic foot a second. There

reddish brown and crumbling towards the edge of the plain; but just above Yamoshima there was interstratified a light gray hard metamorphic shale, and at Yogawa, about midway, there was a black clay slate with imperfect cleavage. I take it that the mountain range between Shimodzuke and Kidza is of anticlinal structure in the main; and the slate of Yogawa may perhaps correspond to that of Ashio.

The hot springs at Yamohara are at the edge of the river, and are two in [illegible], besides another suidlobe of like character on the opposite shore. One of the two had a temperature of 45°C., and the other 62, and each a yield of perhaps twenty gallons a minute. The water seems to contain no sulphur, has a very little gas, and leaves a very slight white, apparently calcareous deposit. Near Ashinomaki, some half a mile below the village, there are three springs in the river Shinga, [illegible] the water escapes, and the temperatures are 43°, 43° and 41°C. There seems to be no sulphur in the water, and no taste [illegible] a very slight deposit of white salt. On the

[illegible] [illegible] [illegible] [

Shari, there was a hot sulphur spring of abundant yield; and that there was limestone there.

From Takahara to Shari there were many exposures of rock still of the Kumoshotan Group, chiefly quartz porphyry, often greenish gray in slot weathering light brown, but sometimes with a dark gray matrix; sometimes with highly rounded and somewhat angular fragments of [illegible] siliceous slate and pinkish quartzite, making it a pudding stone; sometimes syenitic or even a true syenite; sometimes crumbling into gray or light brown sand; sometimes forming high cliffs near the river or high up on the mountain side. Similar exposures were seen here and there for four leagues northward from Shari as far as the mountain pass about 3000 feet above the sea, near Yokogawa, the boundary of Aidzu; sometimes with rather angular pebbles as large as the fist. Thence northerly down hill by a narrow valley through Itozawa to Kawashima, four leagues, there were similar rocks; and then four leagues northeasterly with a rather more open country and fewer roadside exposures through Nakamoi and Tajima to Surahara, are

and these like rocks were seen, and many of
their pebbles found in the shingle of the rivers.
From Narahara I crossed the river and went
by the more difficult road past the Gunchara
and Ashinomaki hot springs to Wakamatsu (ten
leagues), the principal town of Aidzu (about 800
feet above the sea); while Mr. Edachi with the
baggage went by the more commonly travelled
road. From what he saw it would appear that
only the same ancient crystalline rocks occur
along that road. At the river crossing of
Narahara there were exposures of light gray
soft shaly sandrock, with nearly level dip,
apparently of like age with the Toshibetsi Group
of Yesso or the oil bearing rocks of Echigo.
It would seem to be of very limited extent,
confined to the lower most part of the valley,
near the river level. The other exposures along
the road, pretty frequent all the way to within
a couple of leagues of Wakamatsu, where the
valley opened out into the beautiful, basin-like,
mountain circled plain of Aidzu, were of the
same ancient character as before;
reddish gray, very hard quartz porphyry though

At Wakamatsu rainy weather enabled me to write and send back a report on the Ashio copper mines. Also we were consulted about the Shigamori gold mines about a league distant to the east; and some specimens of their ore were brought to us. The vein was carefully described as at one place 0.15 wide for a length of about two fathoms, but in general only 0.01 or 0.02 wide, and not by any means averaging more than 0.05 in width. The ore was [illegible] cellular quartz, part of which (a heap described as about 1/2 long) they had reduced to a red powder and washed, obtaining a small quantity of magnetic iron and that formed a heap about 0.02 long, or perhaps one thousandth of the ore. In the magnetic sand there were two or three minute specks of gold, perhaps one thousandth of the little heap; making the gold to be only one millionth of the bulk of the whole ore, or say one thousandth of one per cent. of its weight; and certainly it can hardly be ten times as much as that or one hundredth of one per cent. There was also some tabular barite with the ore, and some granular gypsum

containing a few minute crystals of [illegible]. The country rock appears to be a general whole, very hard quartz porphyry. Reckoning the cost of mining to be the same as at Ashia mentioned [illegible] at almost 125 lbs (15 [illegible]) of ore, obtained from a space 5 ft by 4 by 0.5, would cost for mining from $13, [illegible] to $[illegible] and even if the gold were one hundredth of one per cent. it would be worth only four dollars. It is very clear then that there would be no profit in working the vein. It is not surprising therefore that the mines were abandoned about two hundred years ago; and though they were reopened by the Oxno Company a few years ago were quickly given up again.

We were consulted also in regard to a mine at Onogawa about eight [illegible] by road northerly from Wakamatsu, where an enthusiastic country man had for about twenty years been digging an adit now 25 fathoms long, led on by a vein of [illegible] mining stuff, of the color of gold, perhaps iron pyrites; and at last had for nine feet been in a vein that was said to be ash colored with

red spots, and that, as he avered, had yielded when ~~xx~~ ~~xxxx~~ smelted by him with lead a large proportion of silver. He advised his patron, who furnishes his capital, and who consulted us, to obtain it possible an impartial and trustworthy ~~xx~~ analysis of the ore from the government of Minny Office.

On Sterling forward from Wakamatsu I made an excursion to Tonchugi at the mouth of the beautiful Swanshiro Lake (sometimes called Bandaiko), two leagues to the east and some 1750 feet above the sea; and near it found blocks, apparently not quite in place, of old volcanic dark gray andesite containing glassy triclinic feldspar (probably) oligoclase, augite and magnetite in a dark gray matrix; and on the way near Yasubara, at the entrance to the hills, saw a exposure of very soft tufaceous light brown gravel in which there were egg sizeables of grayish white, long fibred pumice containing glassy triclinic feldspar (probably) oligoclase, augite and magnetite. From the road here were also views of Bandaisan, a high mountain some three leagues to the northwest of Wakamatsu, with dotted

[illegible] in clouds [illegible] from the [illegible]
volcanic mountain, and [illegible] the [illegible]
The Peak was [illegible], as [illegible] the
weather [illegible] the [illegible] was
calm, and after [illegible] the Queen's [illegible]
steering by [illegible], [illegible] with the [illegible] of
the [illegible] [illegible] [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible] [illegible]
the [illegible] [illegible] [illegible] [illegible] [illegible] Lower
Red Lake, [illegible] [illegible] [illegible] and a
half [illegible] the [illegible] [illegible] [illegible]
[illegible], [illegible] [illegible] above the sea, and a
[illegible] of [illegible] [illegible] the [illegible] [illegible]
[illegible], [illegible] the Islands of [illegible]. [illegible]
the [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
were [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible], [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
the Village [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[

said to be about twenty feet deep, marks 37°C; and both are yellowish red with a great deal of iron rust, of which there is a copious deposit; and both are very gaseous with small bubbles. The yield of each is perhaps six gallons a minute. About a hundred yards to the north, in the very edge of the village, there were five small wells some four to nine feet deep, four of which are still visible; the deepest one with a temperature of 20°C. and the rest cold, but three of them at least mixed with surface water. The yield of salt water is also less than at the two main springs, and those that are mixed with other water are especially weak in salt, and one of them is colorless; but the others are red with iron rust. A hundred yards to the south of the main springs there is a well about nine feet deep not very salt and with a small yield of water, a little gas and a little iron rust. No salt has been manufactured at Oshio for half a dozen years past; but before that it was made according to the village statement for a thousand years. ^ The water was allowed to

stir known for a certainty to have been made for about 250 years.

Camp, and began the second northward
ward of the hill that separates the main
of Yellow Pine Mountain Range. The
hill, 100 feet (perhaps a thousand feet
above the sea) and ascending to Summit (a compl.
ranges) the next hill Eastward of Hill Summit
Sandrock, sometimes called Brown,
afterwards the Second Hill Eastward
Creek of Mississippi Ravines. Hill
near at hand and called Eastward
Summit Hill. Before the Eastward
Eastward, Eastward, Eastward
Camp & Black Hill and Creek & Hill
Eastward. On the hill Eastward
Eastward Eastward of the Eastward Eastward
Eastward, Eastward, Eastward Eastward Eastward,
Eastward Eastward Eastward Eastward
much as Eastward Eastward Eastward
Northeastward. Eastward Eastward Eastward
Eastward, Eastward Eastward Eastward
Eastward, Eastward Eastward Eastward
Eastward Eastward, Eastward Eastward
Eastward Eastward Eastward Eastward
Eastward Eastward Eastward Eastward
Eastward Eastward

found some imperfect fossil shells in clay from Wales among the rejected rock [illegible] for a layer of 30 degrees that, part [illegible] from here many expenses a [illegible], somewhat flow stained pale but rather light, even [illegible], scattering red on clays, probably of like age, hence named by the Rev. [illegible] Bunbury from Bunga expenses very poor, and have of decayed pale very light and red like the less hope. At the [illegible] [illegible] [illegible]

worth two dollars a picul at Kiyoto; and costing a quarter of dollar a picul for carriage by sea to Osaka or thrice that by land. Of the precipitated copper about 30 kamme were made, or one twentieth or one percent of the ore; and it was worth a dollar a kamme at Osaka. It is very plain that such thin veins of such poor copper vein much hardened cannot be worked profitably; and that for the green vitriol, even the cost of fuel, cheap as it is not counting that of mining, is as much as the value of the vitriol at the works.

We were shown there a specimen of ore from the Nobara lead mines, three leagues distant to the northwest, worked about twenty years ago and abandoned after three years trial. The ore shown contained a little galena and still far less copper pyrites sprinkled through dark brown zinc blende. Only lead was made there.

The Kanazaki mines are at the outlet of a small bay or a harbor that extends to Maedzuru with a depth, it is said, of

and crumbly granite

a half westward to Toyooka, in Tajima, through a country of moderately high hills, we saw no signs of any such recent rocks, and found numerous exposures of crumbling light brown, sometimes reddish gray granite, containing a great deal of black mica and very little, if any, hornblende. There were also many exposures of the light brown sand into which the rocks crumbles. About halfway, at the pass about 400 feet high between Masudome and Monaka, there was a case where a layer about a foot thick of the reddish gray crumbling granite was enclosed between two beds of brown shales, in all an exposure of some ten feet in thickness. The strike there had changed to nearly east and west, and the dip was 70° north 5° east. A few hundred yards short of that place the crumbling brown granite appeared partly to pass into a fine pebble rock. About three quarters of the way, just beyond Kumihama there were a few exposures of Kamoikotan hard brown shales near brown granitic exposures on either side though not visibly in contact with them.

Sigera is on a hilly [illegible] about 3 miles above its mouth. The [illegible] of the hills and [illegible] 1st [illegible] & the stone [illegible] in the [illegible] corner of the province. Sigera is here in an alluvial plain of [illegible] and [illegible] clay but on a hillside near [illegible] beyond Sigera and Sondays a league on a road from Sigera to [illegible] [illegible] of a [illegible] green [illegible] rock crystalline, pebbles, [illegible] of egg & less size [illegible] of [illegible] or a foot in diameter, a very hard [illegible] [illegible] [illegible] but none of [illegible] not black slate, in a matrix of [illegible] [illegible]. A couple of leagues further on, beyond Chera, there were exposures of reddish and greenish [illegible] [illegible] [illegible] [illegible] and [illegible] [illegible] [illegible] [illegible]

grains, and it is said to be the same as the country rock of the silver veins. The chlorite appears to have been altered from hornblende, though the form is generally a little indistinct. The oligoclase crystals are of the same color as the matrix. The whole rock has perhaps been somewhat altered by the infiltration of magnesian waters, just as the neighboring serpentines have probably been to a still greater degree. For half a league up the narrow valley easterly to the Kanagase copper mines there are exposures of similar rocks; and at those mines there is like porphyry but much more visibly quartzose. In the mines there is also much dark gray serpentine that is very calcitic, partly invisibly so, but partly in thin white seams, and there is a reddish and greenish dark gray impure serpentine ~~xx x xxxxxx~~ containing quartz grains and probably invisible quartz, and thin white seams and small grains of calcite, apparently an intermediate stage in the transition from quartz porphyry to serpentine. It is possible that the magnesian waters that effected the change rose from below through

(Stephanite)

(Stephanitz)

water level about its greatest horizontal length, 600 feet; at the next level (131 feet lower) it was 450 feet long; at the third level (131 feet still lower) its length at the time of [illegible] visit was not yet known but appeared to be much less and so far only about thirty feet of "good ore" (fourth class; that is, yielding about 3½ hundredths of one percent. in silver and 1/8 hundredths of one percent. in gold) had been found; and it was feared that on the fourth level (which had not yet reached the shoot) there would be no ore to speak of. The other shoots and veins had not yet been found to be of much importance. The mines are worked in foreign style under the guidance of Europeans; and the narrow irregular galleries of old times are no longer driven, but wide and high ones with iron rail tracks. The mines are of course pumped, but the amount of water seems to be small.

The ore dressing works and furnaces are close by the silver mines; and are conveniently arranged in fine large brick buildings. There are 75 wet stamps and 25 dry ones, of 5 cwt

160 feet

dard green [illegible] [illegible] [illegible] and
[illegible] [illegible] in many places. It has a large
fruit Schinopsis
three [illegible] from Sea (?), [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
is still known throughout the region and is used
for [illegible] handsome [illegible]. It is called
Urundeyuba because small pieces of it [illegible]
in the fire and exploded by the heat in the
manner of [illegible]. Then began explosions of [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]

and northnorthwesterly, but there are changes that mislead.

It is said that at Nakaya near Hiroshima there is an old abandoned copper mine that the government thinks of reopening and one of the Shuno foreigners had gone to look at the place a short time before we came along. Also at a [illegible] of Takai, a small village we passed half a league south of Muraoka, there are said to be very old abandoned gold mines. Likewise at Ushirodani in Ootani village, a league and a half southwesterly from Muraoka there is said to be a gold mine that was worked about five months in the spring and summer of 1877; and some poor looking specimens of its unwashed and washed ore were shown us, without any visible gold.

On our road northerly from Muraoka the black shales occurred again with gentle southsouthwesterly dips, and within half a mile or so, [illegible] underlying one exposure of [illegible] about East [illegible] one

At the village of Ukiah [illegible] Mendocino, in [illegible] [illegible] [illegible]

of yellowish brown hard shaly sand rock; but then the road turned westerly and there were exposures of brown crumbling granite and of reddish gray granite, to the Kamoo Pass, the boundary between Tajima and Inaba (some 1200 feet high). Just beyond the pass there were bits of black slate again. Thence northerly a couple of leagues to Iwai there were a few exposures of greenish gray (brown weathering) shaly looking rock.

At about half a league from Kamoo village and a league from Iwai to the left of our road it is said there is an old silver mine, that is supposed to have been worked three hundred years ago, but was long abandoned. It was taken up again about 1865 and worked less than a year and abandoned again, because they did not get to the rich part of the vein; but the ore yielded some silver. On the road from Kamoo to the silver mine there was a copper mine worked for about three years, about 1865; but it was abandoned, probably because it did not pay

triclinic feldspar (probably)

and magnetite in a grayish, sometimes brownish, green decomposing matrix. Numerous exposures of the same rock with the pebbles sometimes with a gray or reddish gray matrix and sometimes imbedded in abundant level bedded very soft gray tufa sand rock (sometimes a scarcely coherent volcanic ash), were seen on the road all the way west from Yonago in Hooki (23 leagues from Tottori); and came, of course, from the fine conical extinct volcano Sawen ~~mather~~ on our left. At first there were here and there also a few exposures of brown, hard, apparently Kamoi-hotan, shales or of bright brown quartz porphyry both with southeasterly dips; and at the village of Hamamura there was one of gray crumbling granitic rock; and further on again a few of red and brown shales with northwesterly dip; but after the first half dozen leagues from Tottori such exposures were scarcely to be seen at all. The andesite pebbles though once, near Suwamura, with a fresh and firm, reddish and greenish matrix (containing there a dark brown [illegible]

[illegible] [illegible] [illegible] [

1873

The very little mining that has been done took place in April, 1878. There are three small adits within a distance of about 20 yards, in a single lot here, one of which was [illegible] in length, but [illegible] on the same bed, which dips [illegible] 3° west. At one of the drifts, the coal is visible, and measures one foot and a quarter in thickness, underlying some six feet of light gray soft shales, and overlying some six feet of soft greenish gray sand rock weathering light brown. At the other places the coal is said to be of about the same thickness, but is only partially exposed. The coal is black and shining, [illegible] rather heavy. Some of it that had been exposed to the weather for months was still black and firm.

I visited likewise the [illegible] [illegible] near by, about half a [illegible] north of the Pigeon [illegible] [illegible] a few fine articles are made, in the [illegible] style, and it is said to be 100 years old. There is one [illegible]

[illegible] at the
[illegible] and [illegible] of the Bay of Tsuruga, a league
and a half westerly of Kamaishi. Here very
bold extraordinary dark gray and greenish brown rocky cliffs
and sandy beaches, such as are to be seen
in the bays around the northern edge of
Honshiu, but Kamaishi rocks rather
resemble those of Very Port distant south
of the head over Sagami, and Kamaishi
and Matsuyama are found in the hills
here. Yamagami is in a little alluvial
plain on the shore of the bay, but Kamaishi
and Matsuyama are found in the hills
more

on the south bank of the lake he found on the foot of one of the spurs of the main range large basalt columns, and higher up andesite. Perhaps the exposure was somewhat further west than the road we travelled. He speaks also of the occurrence of graphite (a mineral of the hamoikotan rocks) near Tamatsukuri; but none was brought to my notice.

At Tamatsukuri there are some hot springs but they issue from greenish gray or light brown pretty hard sand rock, in places quite hard and a good whetstone, apparently a metamorphic hamoikotan rock. There are three springs within some fifty yards. One, about ten yards back from the river, has a temperature of 64°C. with a yield of perhaps fifty gallons a minute; another at the principal hotel (Nishimura) has a temperature of 62½°C. with a like yield; and the third, at the edge of the river, has a temperature of 57°C. and a yield of perhaps 125 gallons a minute. The water seems to have extremely little mineral matter

in it, and has no taste nor smell; and forms little or no deposit, but perhaps traces of a white one, that may be salt.

At Tamatsukuri and at Sumachi chalcedony, carnelian, agate, green jasper and smoky quartz are cut into small ornaments very heavily. The stones here as elsewhere come no doubt from Kamoi-lotan rocks and are found in several places near Tamatsukuri, almost wholly on the east side of the river, towards Fujina, and inside of Fujina; but one large crystal of smoky quartz was found on the west side of the river near Tamatsukuri. Some of the ornaments are small magatama of green jasper cut and polished in imitation of ancient ones that are found in the ground near Tamatsukuri. The hotel landlord knows of five ancient ones that have been picked up in the village, the largest about two tenths of a foot long. They are of prehistoric origin; are believed to have been made by the gods and are therefore collected and preserved in their temples.

In the temple close by there are three ancient magatama, one is about 0.11 ft. long of reddish chalcedony; another is about 0.07 ft. long of similar but rather paler material; and the third is about 0.09 ft. long of dark green jasper. They are polished, but less finely so than the lapidaries there now know how to polish stones. The lapidaries remark that the carnelian and chalcedony are equally hard but are harder than the vitreous limpid or smoky quartz, which again are of equal hardness.

They showed us some obsidian that had been brought from the island Oki, which is therefore in part at least volcanic. The stone was found too soft and brittle for ornaments, except for round beads.

From Tamatsukuri we went southward eight leagues and a half among the hills and mountains to Minari, near the central ridge of the island. The road at first did not go over very high ground, but had small passes of some 400 or 500 feet in height. Near Minari however the passes

were higher, up to some 900 or even 1100 feet above the sea; and the valley at Minari Duty was about 700 feet high. Within half a mile of Tamatsukuri we came to exposures of light gray granite weathering light brown containing, besides the white, and sometimes slightly reddish, [illegible] and abundant quartz and (sometimes rarely) mica, a little magnetite; and such exposures continued frequent all the rest of the way. The granite was sometimes hard, at least in parts, but generally was very crumbling; and there was much granitic sand. At some points near Minari, there was a larger proportion of magnetite, and here and there a little magnetic sand in the road.

In the region about Minari there are eight iron making places, of which however only three seem to be working, namely at: Amegawa, a league and a quarter easterly from Minari; Une, the same distance south easterly from Minari; and Makibara. The rest are small or not at work and are at:

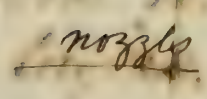
owing to [illegible] protected by [illegible]

The shape is closely like that of the Rocket Furnace a recent invention of western America; [illegible]

[illegible] or 2 feet [illegible]

thermal fire

[illegible] tweers [illegible] are elliptical holes [illegible] high and [illegible] at [illegible] ft. above the bottom, outside and 0.5 ft. inside, so that the heat is kept up throughout the whole length. The progress of the smelting can also be viewed through the holes at the side of the nozzles; and any obstructing slag can be poked away with a small rod inserted there; and at each end of the furnace at the bottom there is a hole [illegible] ft. in diameter for drawing off slag and pig iron, and there likewise the smelting can be watched. At the end of the first twenty four hours that hole is closed and two other similar ones are opened on either side of it near the corners, as the side walls have already become thin. Below the bottom, which is on a level with the ground, there is a layer [illegible] ft. thick of [illegible]


nozzle

[illegible]

The ~~tuyere~~ nozzle is chiefly of bamboo about 0.15 ft. in diameter but at the furnace end is of iron [illegible] of about two thirds of a foot and at the very end with an inside diameter of [illegible] ft. The furnace and [illegible] charcoal [illegible] ore bins, and resting rooms for the workmen are all in a high building about fifty feet square.

twears

the ashes have to be made for each operation.

The clay for building the furnace has to be cought from a distance of three quarters of a mile (11 chos) from land belonging to the furnace owner, and the carriage costs $0.0043 for ten hammes and the digging somewhat more, say in all about one dollar for the 100 or 5000 hammes that are needed for a furnace.

There is always some slag with the drukn at the end of the operation below the level of the bottom of the furnace. The ashes and coals beneath having become somewhat depressed; but it does not penetrate the ashes.

The whole product of one operation is from 720 to 1020 hammes (6000 to 8500 lbs) or about 30 percent, as at Ancagawa, sometimes 700 hammes (10000 lbs); of which the drukn varies from 90 to 480 hammes (750 to 4000 lbs). There are about sixty operations in a year; but the number varies in different years. They are idle in July and August, and in 1898 began blowing on the seventh of September

towers

as ore could be carried very cheaply down in boats on the larger streams (with improved navigation) it would seem advisable to have the iron works at some distance down stream in the larger valleys near good water power rather than far up in the narrow valleys among the mountains, where the supply of fuel would be comparatively small and the water power trifling.

3°. In case the iron manufacture should be very much extended it would be necessary to use coke instead of charcoal; and at places near the sea where it might already be advantageous to do so; for with furnaces built of better materials and perhaps of slightly altered dimensions its use would no doubt be possible. The iron produced would not be so good in quality as that made with charcoal; but the difference would probably be more than made up in cheapness.

4°. The only flux used at present appears to be the wood ashes carefully renewed for every operation in most of those produced

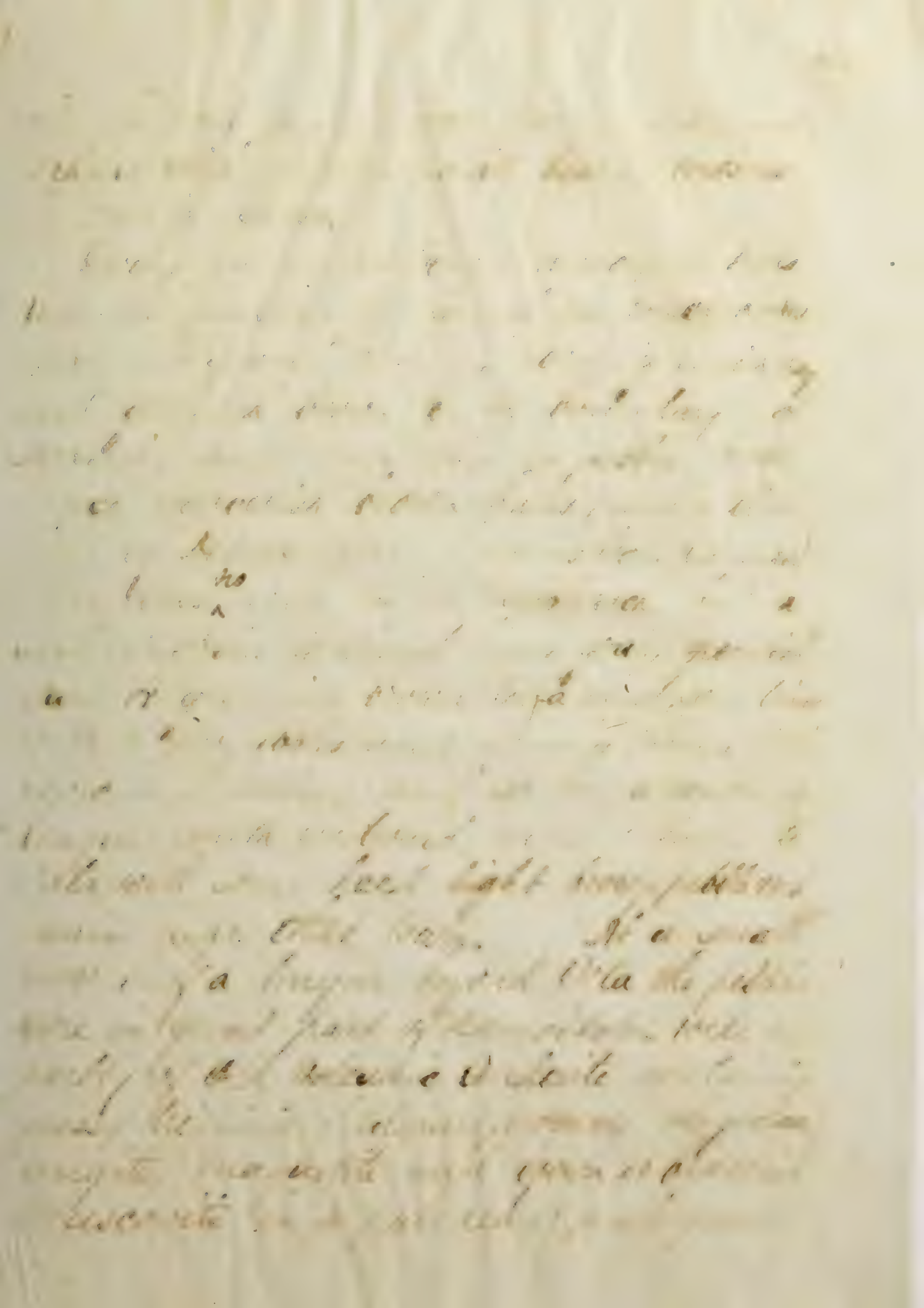
Blister Copper

Minister Plenipotentiary

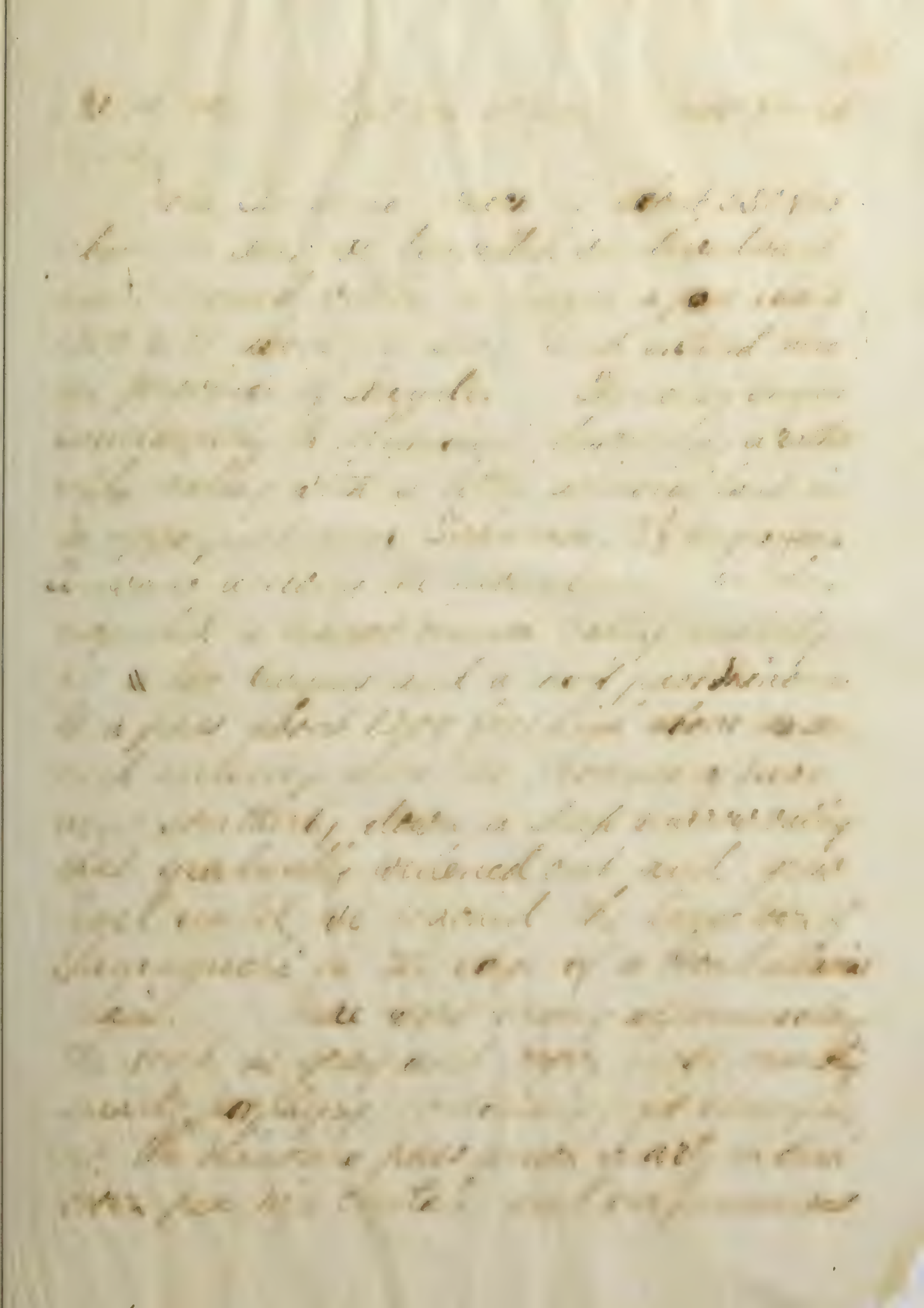
blister

blister

The chief rock of the region forms high dark cliffs along the river and is a hard dark gray glassy and dark brown coarse tufa pebble rock with pebbles of partly vitreous blackish, partly fine granular gray vesicular andesite containing very minute crystals or grains of glassy triclinic feldspar (probably oligoclase), augite and magnetite. And in the cavities a very thin, greenish white rather soft, ~~zeolite~~ lining with a very few extremely minute crystals of heulandite apparently. There are said to be three mines and two ore veins. The veins are admitted to have been too thin to work with profit; but the miners were always in hopes of coming upon some wide vein of which the two were supposed to be mere branches. They said that



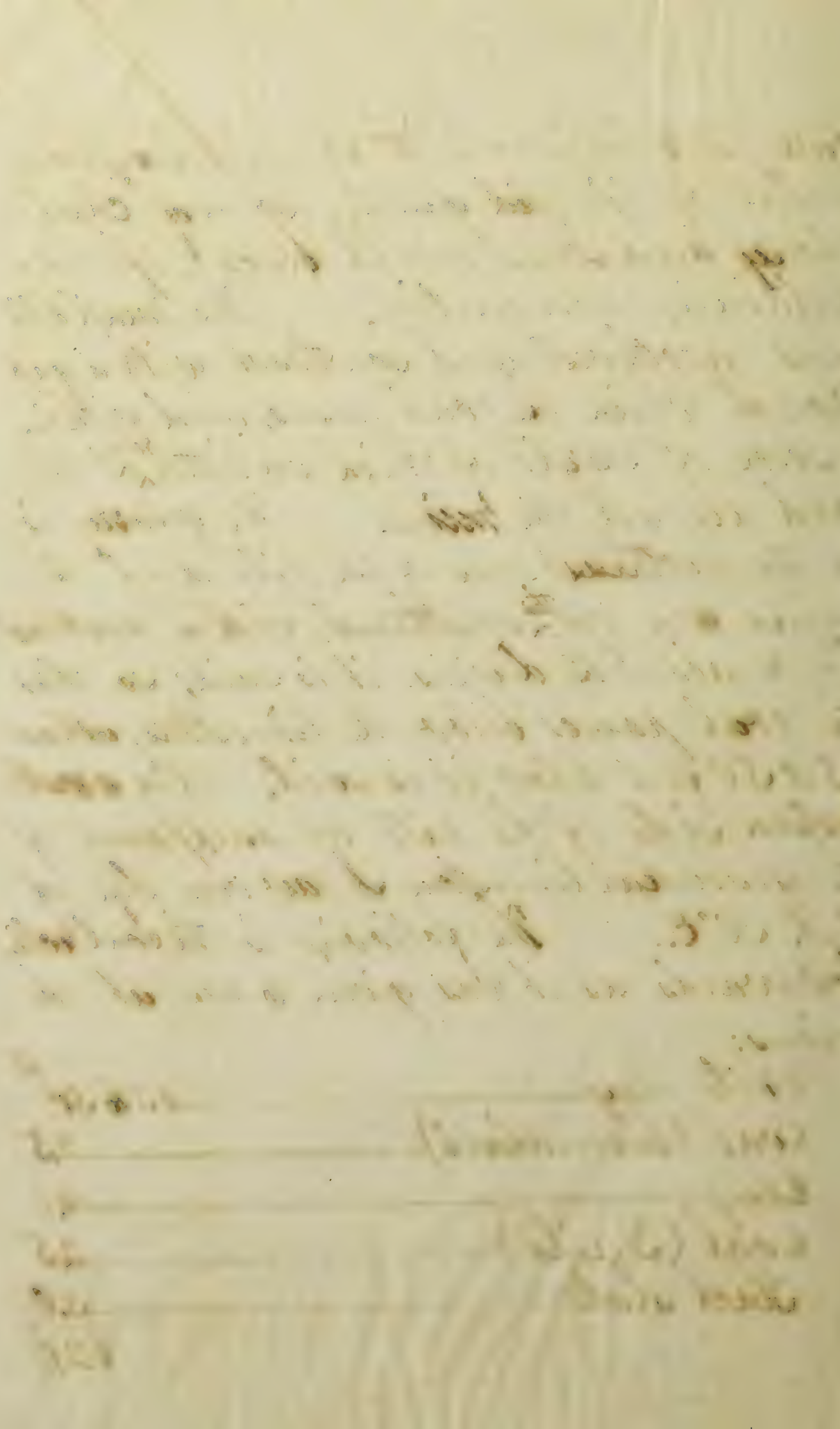
called [illegible] ... [illegible] ...
... [illegible] ...
... [illegible] ...



		32.9
[illegible] coal	Coal	1.5
	Stone	3[illegible]
	Shaddick stone	[illegible]3
Chingoo coal	Coal	[illegible]
	[illegible]	[illegible]
	Coal	[illegible]
	[illegible] stone	[illegible]
	Coal	[illegible]
	Shaddick stone	[illegible]
	Coal	[illegible]
	Shaddick stone	[illegible]
	Coal	[illegible]
	Stone	[illegible]
Santola coal	Coal	[illegible]
	Dark [illegible]	[illegible]
	Coal	[illegible]
		91.2

The coal is mined in the past and stall or bord and pillar system but with very long narrow pillars.

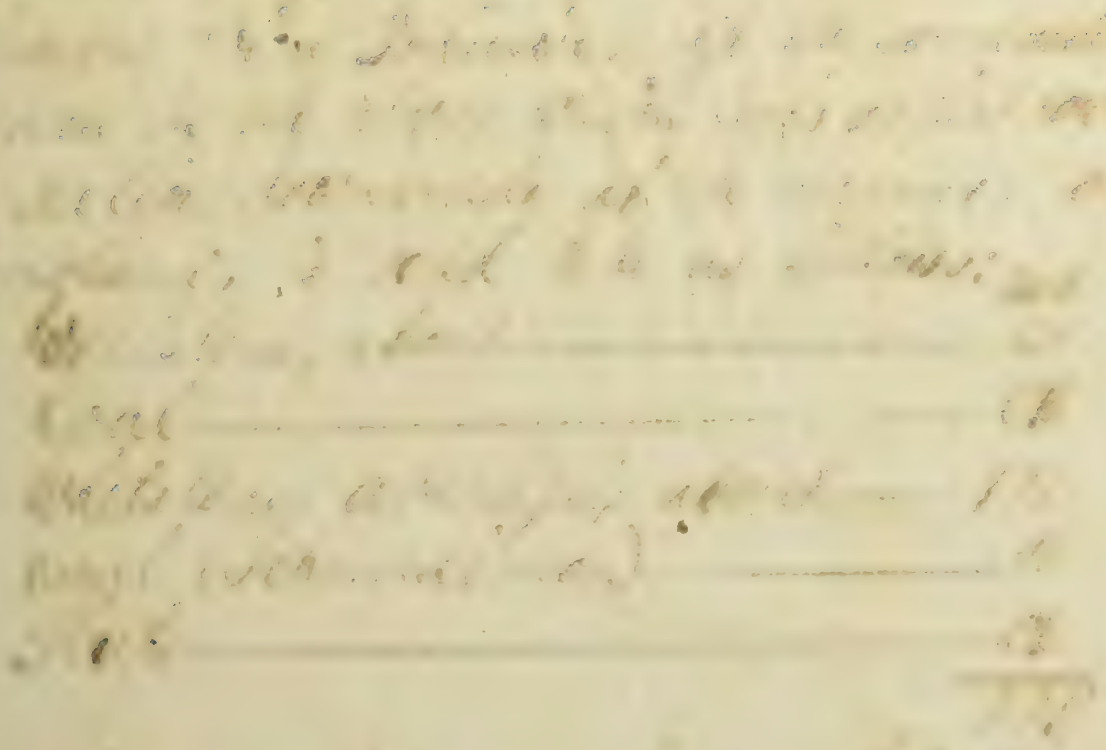
[illegible]

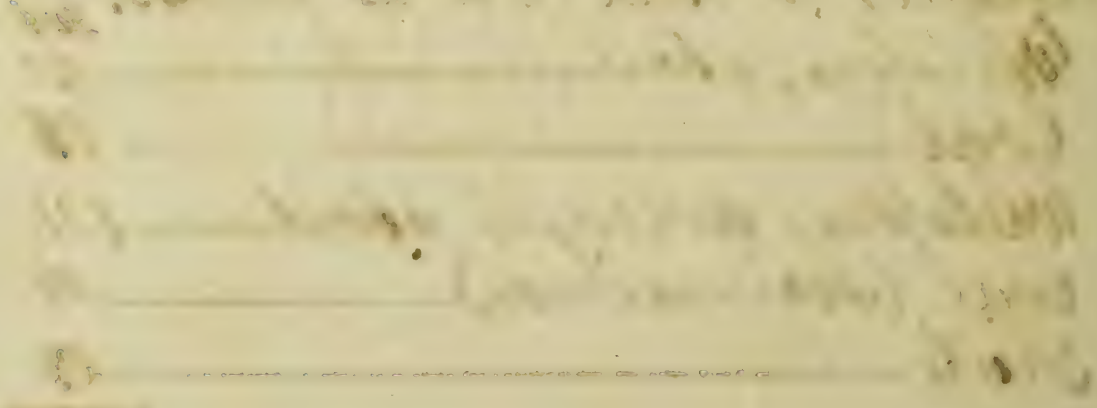


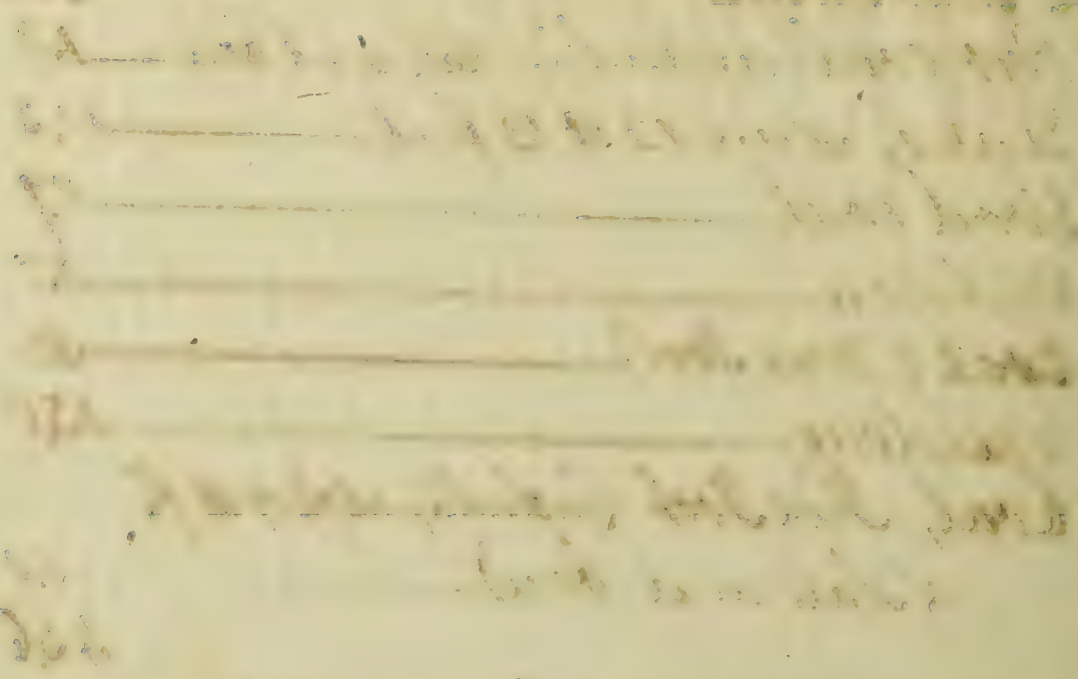
Summai

Hammer

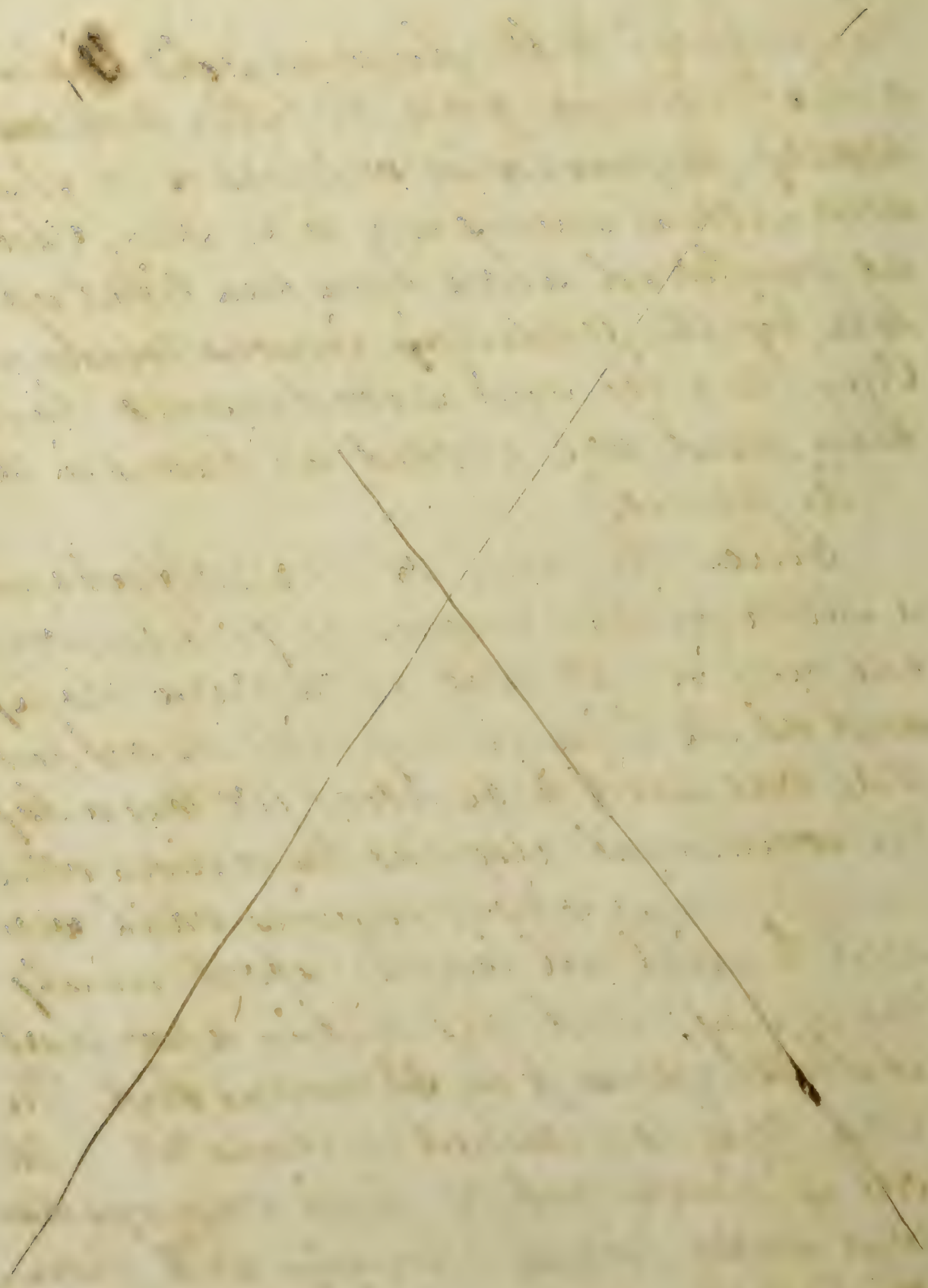
[illegible] with a
[illegible]
[illegible] bearing out the water. The dip was
represented to be 45° northeasterly. The coal
[illegible] is also called the Hankow Five
Foot, and said to be in two layers, one
of three feet above and the other of two
feet below separated by 0.5 ft. of [illegible]
[illegible] clay. [illegible] is a poor coal [illegible]
[illegible]; and on [illegible] is the Eight Foot;
[illegible] (said to be [illegible] coal); below which are
[illegible] Seams and [illegible]
[illegible] 2½ ft. of poor coal overlying [illegible] clay.
The Eight Foot coal is [illegible] [illegible]
[illegible] and is [illegible] to be sold at Ningpo
[illegible] hand mouth [illegible] the river) for
$11.15 [illegible] ($1.87½ a ton);
and the freight to Ningpo costs $[illegible] [illegible]
$2.75 [illegible] [illegible]
[illegible] and $[illegible] [illegible] by [illegible]
[illegible] Wakamatsu the freight costs a dollar
more than [illegible] piecework. It was expected
that the Hankow Five Foot coal at Hanyang
would [illegible] $[illegible] [illegible] piecework



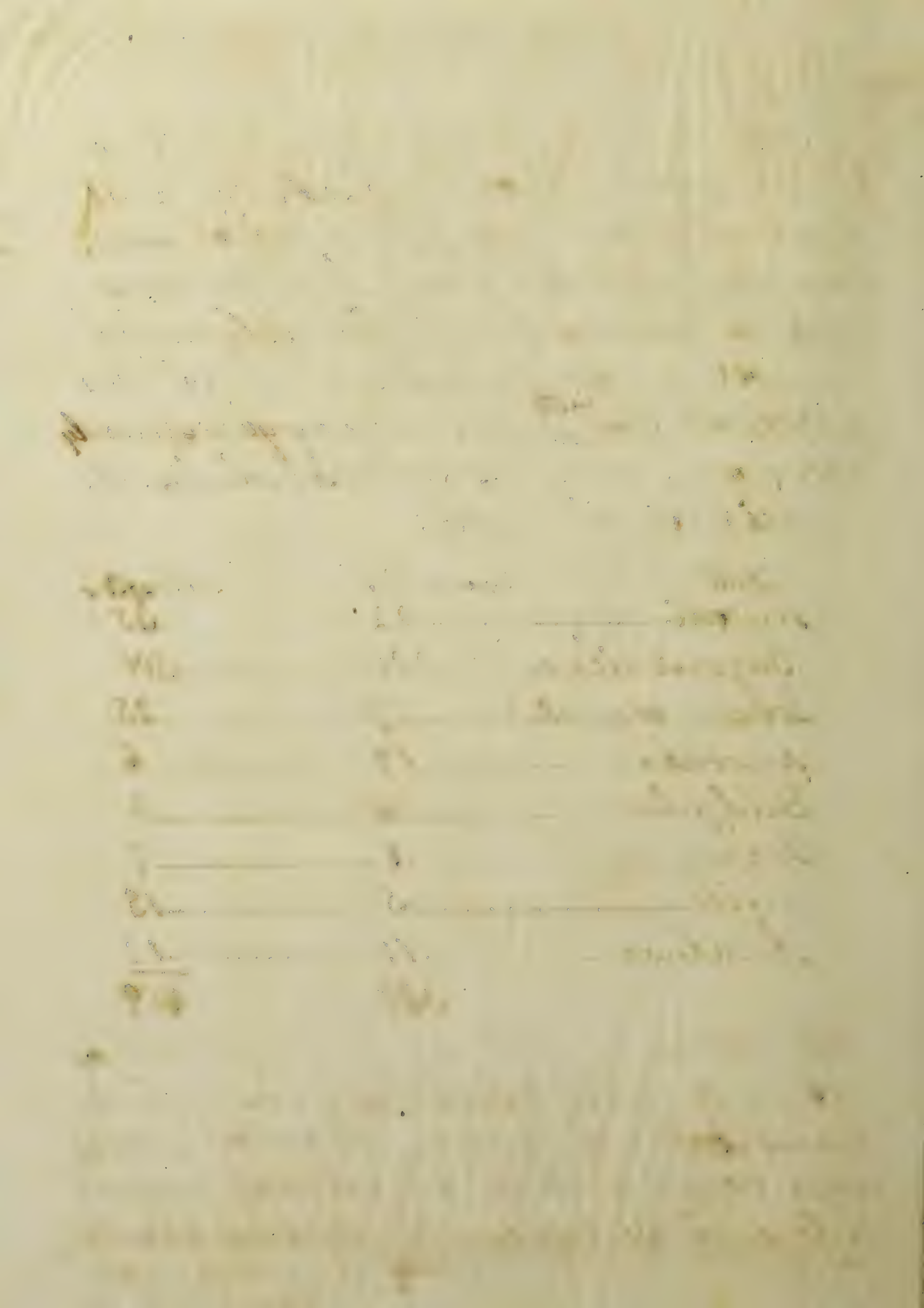


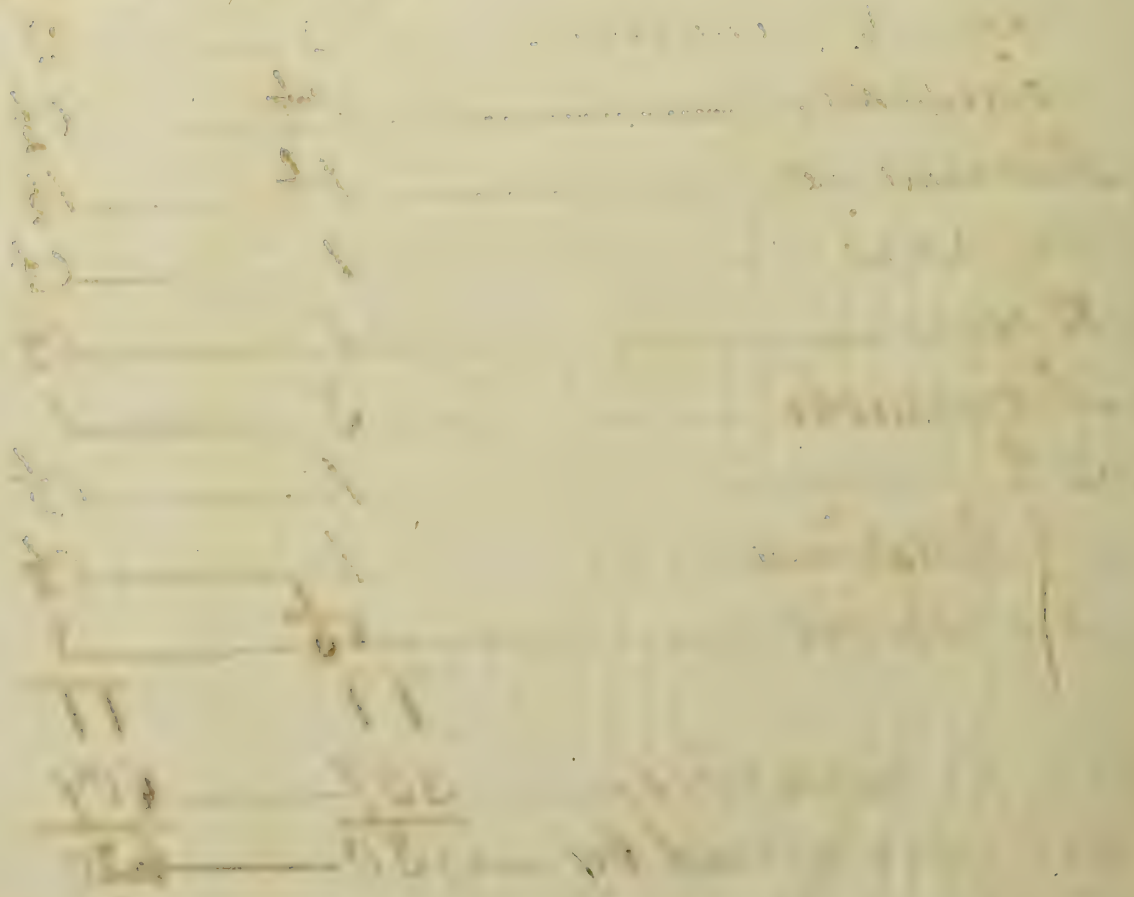


and beyond Imabu lu, the principal town of the region.

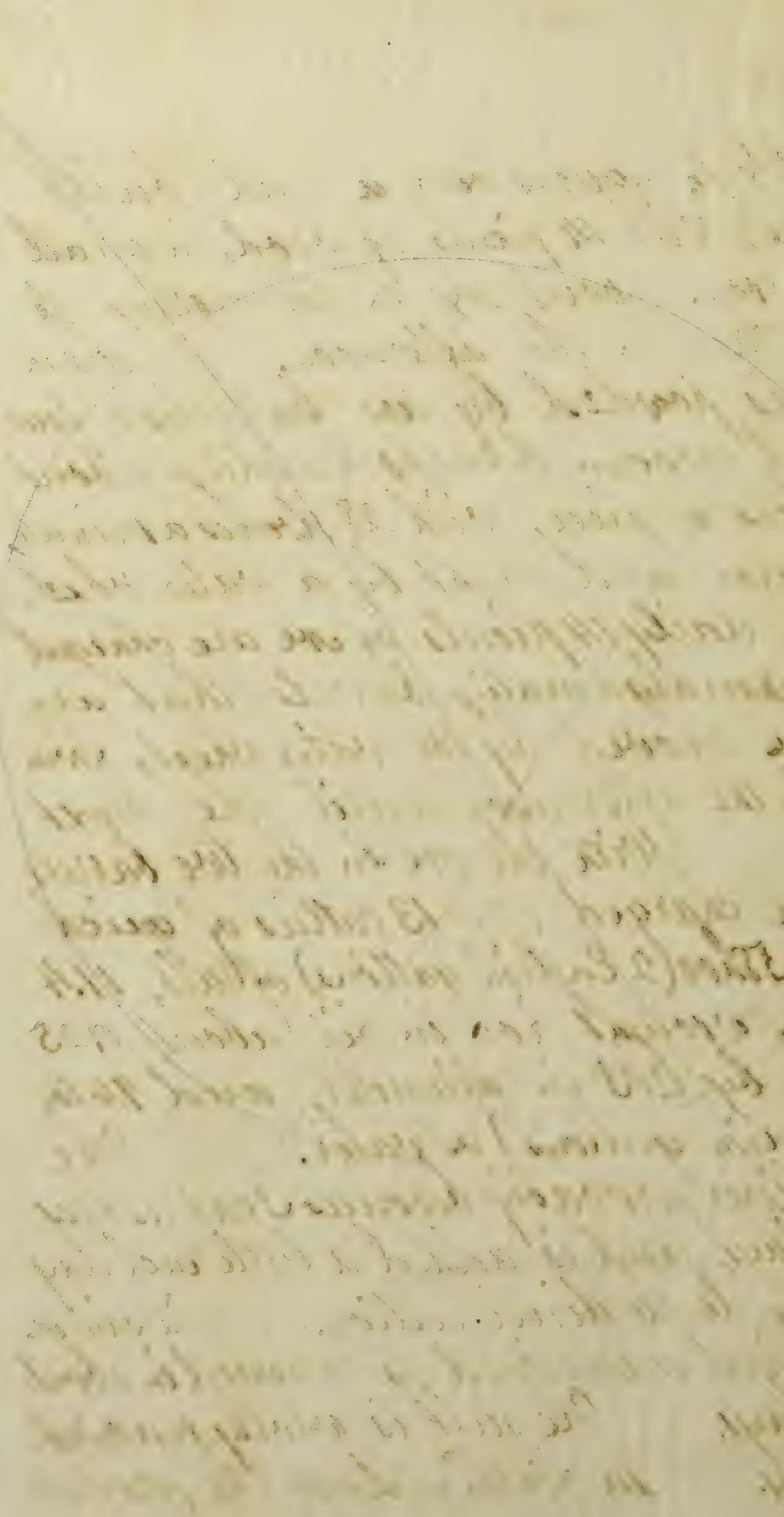


We could get no very definite information
about the Hugo copper mines. Apparently no system are worked, but do not flourish.





Washington



to Kagoshima

Then the ore is powdered by two batteries of four iron shod wooden stamps weighing about 30 catties apiece, with 28 strokes a minute moved day and night by a water wheel. Then the ore is roasted with 5 shoo (8 English gallons) of salt in four shallow open pans about 2½ ft. square over a mud built furnace with 14 piculs of wood, in small sticks, from about six in the morning to about three in the afternoon. Then the daily 14 piculs of ore are charged in two amalgamating barrels that are likewise moved by the water wheel, from four in the afternoon until the next noon. With the ore in the two barrels there are charged 12 or 13 catties of quicksilver, 11.4 catties of wrought iron in bits about 0.25 ft. long by 0.05 in diameter, and 7.6 too (38.4 English gallons) of water. The quicksilver probably becomes 3 catties less in ten days, and is added a little each day according to the diminution. The charge of iron just mentioned is renewed in about thirty days. In fifteen days the product

24 hours. Then in each of the other ten successively [illegible] the lower end to the top during about one hour there are charged eight [illegible] of [illegible] fire wood (about 0.15 ft. in diameter) weighing perhaps 20 catties a piece, and measuring 3.4 ft. in circumference, loosely packed somewhat less than two cubic feet. The fire wood is [illegible] in a large kiln some ten feet square and eight high. The firing is completed in about 34 hours. Then the kiln is all closed during the following night and one more night, that is a day and a half. For the previous unglazed baking (Suyaki) four of the large bundles of wood are charged in the lower oven in about three hours, and five of the smaller ones in each of the upper ovens in half an hour, successively beginning at six in the morning and ending about four. The crackling begins after the firing of the main baking has ended but before the opening of the furnace and [illegible]

thick; both of course wholly unworkable, though apparently the best coal beds in all the three provinces. There were also several specimens of pumice tufa and other volcanic rocks from various places, especially in Mtsuma and Osumi. We were told also of a shell heap, perhaps kitchen middens, about a quarter of a mile from the sea shore and separated from it by a gentle slope at Yogo, in Kunakibara village, Tamidzu-gori, Osumi. The shells (small oysters and others) are water worn and form a deposit about a foot deep and are much used for making lime; but our informant knew of no bones nor pottery as found there. The fact that the shells are waterworn would go to show that the heap was formerly within reach of the sea waves. Mr. Aoi Hiu, who has been writing and elaborately illustrating a history of the tobacco plant and its cultivation and manufacture in Satsuma, has inserted in his book the dates of the volcanic eruptions there for the past 1300 years so far as known. He said

[illegible] would [illegible] population [illegible] a [illegible] [illegible] [illegible]

Doubtless of the coal seams formerly

[illegible]

We travelled [illegible] northward generally by a sandy road through wide plains near the sea shore, without rock [illegible] some grained gray cliffs [illegible] of the coal rocks on our left at about five leagues and a half, and other exposures of similar, soft rocks with a few very fragile bivalve fossil shells near Takanabe, at seven leagues, and of like sand rock and shale dipping 15° south 50° east at Sakamoto, about eight leagues, where we crossed some gently rising ground, a couple of hundred feet high, and then descended as gradually to the sea shore at Minidoro, about 13½ leagues from Miyazaki. Meantime, two or three steamers of some size had been crossed near their [illegible], and the shingle upon their moors was made up of [illegible] pebbles, quartz porphyry, quartzite [illegible] and a little black slate, without granite [illegible] limestone, but with a very few pebbles of brown and gray old volcanic rocks. We were told at Minidoro that [illegible] leagues distance between

[illegible] mines is not without a [illegible]
[illegible]. The country rock [illegible] is
[illegible] [illegible] [illegible] and, [illegible]
of many [illegible] [illegible] a [illegible] split [illegible].
A little copper is [illegible] [illegible] [illegible]
the Hackensack [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
at [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[

down to water level (not being it except at Oshirokane). Though the accounts given of them are not on the whole very promising, it seems worth while to have them examined more carefully than would have been possible to me so late in the season (December) and with still so much travelling to do; and if the result of such a reconnaissance hold be encouraging it would be best to make a topographical and geological survey of the whole region with a view to working the mines if the survey should prove them to be worthy of it.

We were shown some samples of iron sand from Kunisaki-goori in Bungo and from Bungo; but none of it is worked, not indeed is any in all Kiushiu. There were granite too from Kunisaki-goori. There was also some gold ore, so called, from Mandila village in Kasuguori, Bungo, where gold is said to have formerly been worked on a small scale. There were specimens of graphite, said to be in small quantity and apparently unworkable, as it was not very pure looking. From

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